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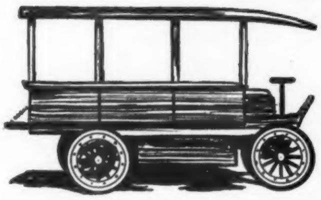
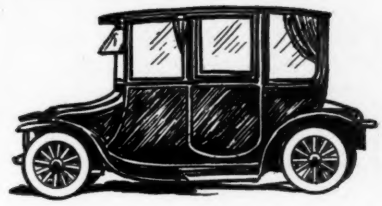
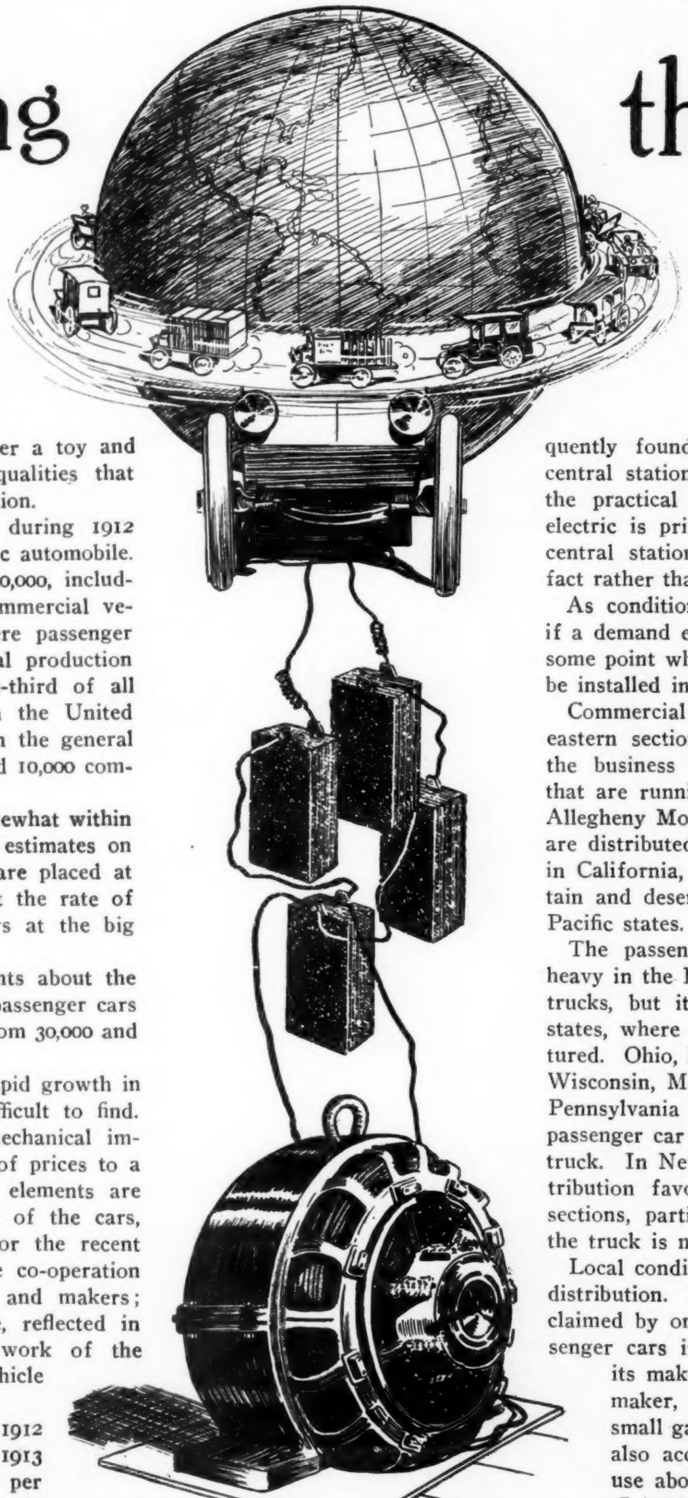
The Automobile



Electric Vehicle Issue



Surveying the Field



REACHING out into new territory; filled with virility; backed by the consumer and aided by the co-operation of central stations, the electric vehicle industry bounded into national prominence during the past year, particularly the past 6 months.

The passenger car is no longer a toy and the truck has shown service qualities that entitle it to respectful consideration.

Material progress was made during 1912 in the development of the electric automobile. Production was approximately 10,000, including both passenger cars and commercial vehicles, of which about 6000 were passenger cars and 4000 trucks. The total production of 1912 represents roughly one-third of all electric cars now in service in the United States, which may be divided on the general lines of 20,000 passenger cars and 10,000 commercial wagons.

These figures are probably somewhat within the actual facts, as are also the estimates on the production for 1913, which are placed at a total of 15,000, apportioned at the rate of two to one, with the passengers at the big end of the ratio.

In case that estimate represents about the actual output of 1913, the total passenger cars in the country will be not far from 30,000 and commercials 15,000.

The reasons underlying the rapid growth in the use of electrics are not difficult to find. Of course, there have been mechanical improvements and an adjustment of prices to a basis of value, both of which elements are important to the increased use of the cars, but the most potent reasons for the recent growth of the industry are the co-operation of central stations with users and makers; the acute demand for gasoline, reflected in its increased price, and the work of the national and local electric vehicle associations.

The electric vehicle output of 1912 and the estimated output for 1913 represent an increase of 125 per cent. in comparison with the production of 1911 and before.

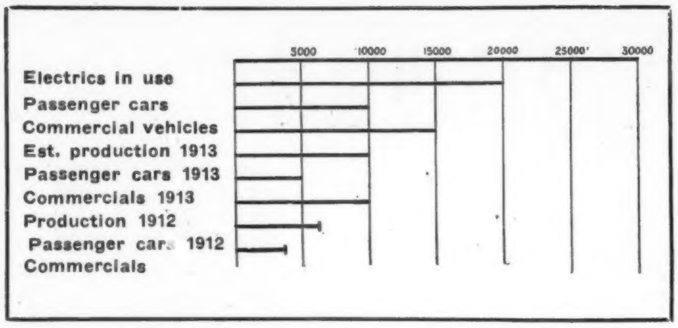
The distribution of electrics is almost as wide as that of gasoline automobiles, taking the states as a basis, but the electrics are limited in their use to the facilities for charging and consequently are most frequently found in the cities. Extension of central stations are being made steadily, but the practical demonstration shows that the electric is primarily a city car and that the central station situation is a result of that fact rather than a cause for it.

As conditions shape themselves at present, if a demand existed for a charging station at some point where there is none now, it would be installed immediately.

Commercial cars are in general use in the eastern section, probably 80 per cent. of all the business wagons manufactured to date that are running being in service east of the Allegheny Mountains. The other 20 per cent. are distributed through the central states and in California, with a scattering in the mountain and desert country, the south and north Pacific states.

The passenger car distribution is not so heavy in the East in proportion to that of the trucks, but it is far heavier in the central states, where most of the cars are manufactured. Ohio, Illinois, Indiana, Iowa, Missouri, Wisconsin, Michigan and the western part of Pennsylvania embrace the section where the passenger car is in larger proportion than the truck. In New England the proportional distribution favors the passenger car in some sections, particularly about Boston, although the truck is making progress now.

Local conditions have much to do with the distribution. For instance, in Cleveland, it is claimed by one manufacturer of electric passenger cars in that city that automobiles of its make outnumber those of any other maker, including the popular types of small gasoline cars. This tendency would also account for the large numbers in use about Detroit, Indianapolis, Chicago, Columbus, Denver and other centers.



Production and prediction in the electric field

According to central station data, the charging of trucks is by far the most profitable element of their business in proportion to the investment required. Figures have been produced showing that the truck business returns are 200 per cent. more in proportion than some other classes of business which the electric companies make determined efforts to secure.

In an effort to increase vehicle business generally, but specially with reference to the commercial trucks, the central station organization has taken up the matter of installing automobile departments at various points where there are considerable numbers of vehicles, or where the possibilities for introducing them are good. Separate departments for such work are conducted in New York, Chicago, Boston, St. Louis, Philadelphia, Newark and other large cities. The effect upon the industry has been astonishingly satisfactory.

The experience of the New Jersey Public Service Company is illustrative of the general situation. The automobile department has been in existence for 2 years. When it was installed there were a few trucks and about eighty passenger cars in its territory. Prior to that time the efforts to introduce the electric were only casual. The first effect of the initiation of the automobile department was to influence the manufacturers to increased efforts in marketing. On December 1, 1912, there were 191 commercial vehicles in service and forty more had been sold but not delivered, and the passenger cars had increased from eighty to 240. The kilowatt hour consumption for electric automobiles increased over 200 per cent. and the income over 100 per cent. The discrepancy between the consumption and the income is to be accounted for by the fact that large installations of automobiles owned by single interests or supplied from electric garages whose rates vary with the quantity of current used, get a lower rate for wholesale lots.

While the same proportionate showing has not been made in some of the other central station automobile departments, the general line results have been similar all over the country where tried.

The special value of the automobile to the central station is that it can be charged at times when other power requirements are small. Until such time as the automobile business shall constitute a constant load during the off-peak hours it will form an extra desirable element for the central stations. That limit is far in the future.

Vehicle Department To Educate Public

The efforts of the automobile departments have been directed largely toward educating the public to the advantages of the electric.

The Electric Vehicle Association of America, a national organization to encourage the use of the electric, has an active membership of eighty-three and a total membership of 317. Included on its rolls are seventeen manufacturers of electric vehicles; fifty-six central stations, and ten accessory manufacturers. Geographically the members are located as follows: Atlantic slope and gulf states, 228; middle states, seventy-two, and in the west, seventeen.

Headquarters are in New York, but active branches are maintained in Boston and Chicago.

Statistics on the electric industry as compiled in the past are fragmentary and of little practical value, but in the future the association announces that careful records are to be kept, tabulated and the results distributed where needed.

Standardization has occupied more attention during the past year than ever before. Particular attention has been given to the dimensions and type of the charging plugs. Uniformity in that particular is very important, as it is quite apparent that an electric automobile is valueless as a vehicle without a charge in its batteries, and the charge cannot be given if the standard plug of station will not fit the car in question. Limits of speed for pleasure and commercial cars have been advocated by some engineers, but as the speed quality is one of the superficial talking points of the salesman, it will be seen that standardization on that point will be difficult. During the year the most striking thing in the line of standardization has been toward battery capacity and wheelbase. A large majority of the manufacturers of passenger automobiles have centered attention on the 40-cell battery installed in a car with a 96-inch wheelbase. Several leading engineers think the 40-cell battery too large. Mechanically the tendency is to follow the recommended standards published by the Society of Automobile Engineers. Such standards have been followed by many of the designers.

The principal items in which efforts are being made to produce uniformity are: Battery arrangement to facilitate charging; the charging plug, receptacle and cable; lamp-capacity; speeds and tires, including fastenings.

Generally speaking, all these matters have been developed to a much greater extent in passenger car design than in commercial.

The work of the association is exemplified in what has been done in the matter of fire insurance. Prior to June the rate was $2 per $100 of insurance, including theft and valued feature clauses. A reduction of 25 cents per $100 was secured through the showing of the committees, and a further reduction of the same amount is now allowed where the theft element of the policy is waived. Liability insurance except in certain specified localities, covering personal injuries or death, can be had for $20, and property damage liability can be covered for $7.50.

Twenty-four Makers in Passenger Field

There are twenty-four manufacturers of passenger cars in the 1913 field. A majority of these manufacturers are grouped in and about Detroit, Cleveland and Chicago, and the electric passenger car propaganda has been preached more widely in those sections than anywhere else in the country. As a result of familiarity with the electric passenger car, its use is wider in the places where it is better known.

While the utmost luxury marks the construction and fittings of electrics, their advocates lay much stress upon their usefulness. Some of the main points urged by them are the following: The electric is a real horseless carriage. Therefore it can be used in excessive heat and in wintry weather without cruelty to horses. It can be left alone without causing worry to its owner. On account of the fact that the owner drives, he need waste no sympathy on the chauffeur, because there is none. No matter how many gasoline cars the business or professional man may have, his electric is most available for errands where waits are uncertain in length. For social service the fact that the car can stand without attendance and is ready for instant use is reckoned an advantage. Of course, all these things do not take into account the noiselessness, absence of dirt, ease of operation in traffic and the other things that have always been urged in favor of the electric.

Speed ranging from 18 miles an hour upward to 35 miles an hour is provided by the electric of 1913. Travel range is from 50 miles to 150 miles to the charge. The price of the average passenger car is $2,800.

The greatest emphasis is laid on the practical use of the electric in suburban service, and the men who make a business of selling say without exception that the electric has certain advan-

tages in that field that are supreme. They do not say that the electric will displace the gasoline car for touring or distance work, but they do maintain that for certain classes of work their car is the best. In the large centers a new field of business has been opened up. During the past year considerable effort has been expended to place electrics with owners of one or more gasoline cars. The idea is that for social, theater and personal service the car fills a niche not completely occupied heretofore. Quite a measure of success has been achieved in this direction and fragmentary figures indicate that fully 50 per cent. of the electrics purchased this year were bought by owners or former owners of gasoline automobiles.

In the commercial vehicle field the chief development of the past year has been the extension of manufacturing. Aside from the increase in numbers, compared with preceding years, the most notable fact has been the introduction of larger models. There are now on the market five makes of 5-ton load capacity and numerous smaller trucks. These are used for transfer work by express companies, for delivery and transfer by breweries, etc. The range in load capacity at present runs from the small delivery wagon, capable of handling 1,000 pounds at a pinch, to ponderous trucks rated at 15,000 pounds capacity. The chief claims made for the electric truck are that it is certain and efficient in operation at moderate speed and cost and that for short haul work it fits well with almost any other type of transportation.

Seventeen Makers of Commercial Vehicles

There are seventeen principal makers of electric commercial wagons. They offer about sixty models of all kinds. The demand of users for particular bodies designed specially for their service has given rise to the practice of quoting chassis prices rather than prices for cars with bodies installed. Chassis prices range from about $1,000 to more than $5,000 and the bodies cost from $100 up to $1,000, depending upon size, type and style.

While some of the largest trucks made are equipped optionally with panel bodies and some of the 1,000-pound cars have open bodies, the general trend of practice is the opposite.

There are almost as many electric trucks of about 2-ton capacity in service as all other sizes together, according to estimates made by the Electric Vehicle Association of America. There are fully one-third of all the electric trucks in service, having a load capacity of about 3 tons. The remainder are divided between the large and small classes, with the latter in heavy majority.

The 1,000-pound wagon, meaning thereby the cars with carrying capacity of from 700 to 1,500 pounds are used for urban delivery service in growing numbers. The 1-ton electric has a wide variation of use. The standard 2-ton and 3-ton trucks are used mostly in transfer work, although city deliveries occupy much attention from these classes and express service in all its variety centers upon them. The larger sizes are freighters as a general thing, although deliveries by breweries, furniture removals and other heavy hauling with the retention of the delivery element claims many of them.

While the manufacturers usually make up some simple body style as a guide to the public, the widest sort of option is always given as to that type of equipment.

The length of the load platform is the best measure for the truck because the standard tread of the wheels limits width to the space between them except where the load platform is built out as far as the hubs, extending over the wheels. Often the main difference between trucks of 1,000-pound capacity and those of 1-ton load is in the greater length of the loading platform. In electric truck construction the power plant and running mechanism are so simple that it is possible to lengthen wheelbases to accommodate longer load platforms, without materially changing the chassis.

Of course, trucks designed to carry double the load of other trucks are built more strongly than the lighter type. In the matter of wheel and tire sizes this is particularly true. As an illustration of the point the practice of the General Vehicle Company, Lansden and Waverley shows that in the 1,000-pound truck these companies use 36 by 2 1-2-inch, 36 by 2 1-2-inch and 34 by 2 1-2-inch tires respectively. In each larger model they install a heavier tire until on the 5-ton truck the rear tire measurements are 36 by 5, 36 by 6 and 36 by 5 inches all dual.

There is a difference between batteries of the same number of cells, the rule being the smaller the truck the less ampere-hour capacity. Thus with the same number of lead cells in all models, the General Vehicle Company's ampere-hour range is between 104 and 324; the Lansden company with Edison cells, using the same number on all models ranges from 150 to 450 ampere-hours and the Waverley company's range is between 135 and 324.

The capacity of the batteries is by no means a guide as to the size of the trucks. With a very few exceptions the batteries of 1913 consist of forty-two or forty-four lead cells, or sixty cells of nickel-iron.

Amperage as a Measure for Truck Sizes

Regarding the operating range of the 1913 trucks it may be placed generally at between 30 and 60 miles to the charge. The average for the largest sizes is about 35 miles although 50 miles is claimed for one or two of the big fellows. In the small delivery cars 55 and 60 miles to the charge is claimed.

With one exception the cars of 1913 are equipped with left-hand steer. There is little new about the motors except the tendency to locate them at or near the axle, reducing the length of the driveshaft where drive by chain has been abandoned.

Chain drive is used by fourteen companies. Argo drives by bevel gear; C. T. uses worm gear on its two smaller models and spur gear on the remainder of its line; Walker drives by internal gears the motor being built as a unit with the rear axle; Waverley uses bevel gears for its small models and chains on the larger cars.

The use of I-beams for front axles increased largely since 1912, a clear majority of the makers now making use of such axles.

What has been said about individual needs in body construction applies as well to chassis and many companies make a specialty of filling orders for trucks of extra capacity. The General Motors Company and the General Vehicle Company each make a 15,000-pound wagon, while intermediate sizes can be had from almost any of the manufacturers in addition to their regular lines.

Summed up, it may be said that the commercial vehicle branch of the electric vehicle industry is better seasoned; that the few structural changes appearing this year are mechanical refinements; that the power is greater and range of operation wider in actual practice and prices are steady throughout the line. The tendency toward apportioning the load in direct ratio to the tire sizes of the front and rear wheels and between the right and left wheels, front and rear, together with the improved spring suspension will have its effect on tire service and the life of the mechanism generally.

Returns from fifteen cities taken at random throughout all sections of the country give the general trend of the distribution, covering over 25 per cent. of all the cars in use.

How the Cars Are Distributed

City	Passenger	Freight
Chattanooga, Tenn	..	4
New Orleans, La	10	10
Seattle, Wash	125	10
Dayton, O	150	12
Marlborough, Mass	1	..
New York City	498	1583
Newark, N. J	238	136
Minneapolis, Minn	525	45
Washington, D. C	654	255
Chicago, Ill	2200	460
Los Angeles, Cal	500	35
Wilmington, Del	15	6
Asheville, N. C	6	2
Providence, R. I	25	20
Denver, Colo	850	37
	5797	2615

Electric Vehicle Association of America

Brief History of the Organization, Its Aims, Activities and Methods — What It Has Accomplished

By Arthur Williams
President Electric Vehicle Association of America

THE Electric Vehicle Association of America was formally organized on September 1, 1910, for the purpose of promoting the adoption of electric trucks and pleasure vehicles. Up to that time manufacturers of current-propelled cars had found the cost of production high, owing to comparatively small sales; makers of batteries had, consequently, too small a market for their wares; while central stations, seeing but little demand for current for charging, had been setting the price for such supply at figures which tended to discourage the use of electric motor cars.

Accordingly, twenty-nine delegates of these three distinct interests, realizing that a co-operative campaign to bring the electric vehicle into greater public favor would be of far-reaching value, formed the Electric Vehicle Association. In 2 years its membership had swelled from twenty-nine to 335, and it at present represents companies having a combined capital account of more than $500,000,000. While in the beginning the activities of the association were confined principally to New York City, today its influence, as well as its membership, has spread all over the United States, manifesting itself in thriving branches at Boston and Chicago with newly formed centers at Philadelphia and San Francisco.

Having thus outlined briefly the formation and internal growth of the Electric Vehicle Association of America, it is best to turn at once to the more important questions: What has it accomplished? What methods have been employed? Why does the association believe in electric vehicles? What does the association hope to do in future?

First in importance comes the test query as to definite results already obtained. In New York City between July 1, 1911, and July 1, 1912, the number of electric vehicles in use increased 45 per cent. In St. Louis during the first 6 months of 1912 one central station reported a gain of nearly 37 per cent. in revenues from charging type of car; and in Chicago an authority on electrical affairs estimates that electric trucking has grown 400 per cent. in the last 2 years.

These examples, to which others might be added, serve to show the remarkable gains which the electric car has recently made; and these facts are all the more worthy of note, since it is well known that gasoline cars, especially for business uses, have been pushed forward rapidly during the same period. Now, for this spurt in the electric vehicle industry, the Electric Vehicle Association of America holds itself in a large measure responsible. The leap forward is, in the belief of many motor car builders and central station managers, a direct and comprehensive result of the association's activities.

Besides doing much to spread belief in current-driven vehicles, and thus hastening their adoption, the society has also turned its attention to making provisions for greater convenience in operating cars. As a step in this direction it has brought about the compiling of lists of charging stations so that car owners may find them without difficulty. It has also urged the adoption of a uniform sign throughout the country, to indicate battery-charging stations, and is at present designing such a sign. It has also counseled the multiplying of these replenishing stations so they may be within easy reach of all vehicle owners in large cities. The association has succeeded, besides, in standardizing the charging plug so that it may be used for various makes of cars.

We come next to methods of work. Those pursued by the Electric Vehicle Association may be summed up under the following heads: investigation; exchange of ideas; and publicity, this last term including both direct and indirect advertising.

In order to investigate various problems, members of the organization are divided into committees such as those on insurance, standardization, rates and charging stations, and operating records. A rapid interchange of ideas and information is brought about at the association's monthly meetings. At each of these a paper is read and discussed, being afterwards published in *The Central Station*, the association's official organ.

The publicity work of our organization is aimed directly at the general public. When the Electric Vehicle Association was formed people in general did not know enough about the advantages of electric vehicles. They were sceptical; they had heard that battery-driven cars and trucks were impractical. It was to combat this widespread ignorance that a co-operative educational and advertising campaign was planned in the fall of 1910. Its scope was to be the advertising of electric vehicles in general, without regard to special qualifications of various makes. The work thus started has been so emphatic a success that a sum of $50,000 is now being spent by the publicity committee, and further funds will be ready as soon as they are needed.

No society could push with enthusiasm a cause in which its members did not believe. It goes without saying, then, that the Electric Vehicle Association of America believes heartily in electric vehicles. However, it is exhibiting no blind, unreasoning faith, for it does not urge its wares upon the public for all purposes. It recognizes, for instance, that the gasoline car is preferable for long-distance hauling. But it also knows, from intimate experience, that electric trucks and pleasure vehicles, are fitted to excel other automobiles for city use, delivery service and short-distance hauling. For these purposes it has unlimited faith in the electric motor car, because of the latter's dependability, ease of operation in crowded thoroughfares, simple driving mechanism, economy of maintenance and the reduced fire-risk incurred.

In looking toward the future, the Electric Vehicle Association of America expects to bring about a stronger organization of its own forces with branches in many of the principal cities of the country. Besides working continually for the more general use of electric vehicles it will also bend its energies toward the further standardization of cars, toward improvements in batteries and the establishment of more charging stations, not only in cities but also on routes connecting large towns. Moreover, it prophesies an increasing urban and suburban use of electric vehicles, owing to more generally diffused knowledge of their merits. And this, it is expected, will lead to the gradual disappearance of the horse from city streets.

It has been estimated that the amount of trackless hauling in this country is sixteen times as much as that carried on by railways, and of this, 80 per cent. is done in cities, where electric propulsion could accomplish it more safely, quickly and economically than horse-power. When this becomes an established fact it ought materially to lessen the price of goods to the ultimate consumer.

Future Bright for Electric Automobile

Field of Usefulness Is Widening in City and Suburban Service with Greater Travel Radius

By Manufacturers

Sales Managers Express Views on Subjec

PREACHING the propaganda of the electric has proved to be the most efficient means adopted so far to widen the use of such automobiles. The simple fact that they are more widely used in territory adjacent to the places of manufacture proves that those who know them best like them best.

Of course, from the viewpoint of the manufacturer the other essentials have been developed and the following symposium by leaders in the industry indicates the uniformity of opinion.

They bring out the special elements covered by the electric and take an optimistic peep into the future.

Suburban pre-eminence is claimed throughout the industry. The attainment of the real horseless vehicle is asserted. The installation of fleets of electric trucks is pointed out as an indication of the attitude of large consumers toward the commercial vehicle. The elimination of the chauffeur generally in the passenger car field is reckoned as a credit item. But through all the statements runs the plea for more thorough education of the public; better garage facilities and concert of effort by all elements associated with the industry.

Fine for Suburbanites—Brand

IN reference to the future of the electric car covering a period of the next 5 years, this is rather in the realms of prophecy except as we analyze same from present and past conditions. The constantly increasing difficulty of transporting the street cars' patrons of the larger cities with comfort to the passengers is impressing the desirability of electric brougham ownership on an increasing number of people. There is no immediate remedy in sight for radically bettering public passenger conveyance conditions, even with material additions to surface and subway lines.

While the American business man of means may submit to discomfort in his own travel to and from his office instead of avoiding the discomforts of public conveyance travel by electric car ownership, as soon as it is impressed upon him that these discomforts as far as his family are concerned can be avoided, he is very likely to become numbered among the many satisfied owners of electric cars.

Suburban residence is more and more attracting people of means who are in position to afford electrics. A drawback, however, of suburban residence to those dependent upon public conveyance transportation, is the infrequency of the train or car service.

Good roads agitation that has been going on the last few years has resulted in splendid suburban roads for considerable distances around large cities, and over these roads an electric properly equipped with batteries is capable of traveling from 70 to 100 miles per charge. It is an admirable means of transportation for the suburban resident, making possible trips to and from the city at will, giving to suburban electric car owners means of keeping in touch with their circle of city friends and acquaintances, and permitting the advantage of city shopping and entertainment, all independent of train schedules and train service.

Professional men and women desiring a dignified conveyance of such simple mechanism as to permit of operation without mechanical skill, are rapidly becoming electric car owners.

The many city transportation uses for which an electric is adapted, make this type of car one whose ownership is a pleasure. All of the above conditions are with us to-day, and they all tend towards increased sale of electric cars.

With the rate of growth there has been in the sale of electrics during the last five years, and with the showing of utility and good service that is being made by them, the next 5 years will take care of themselves.

There is no doubt that there will be improvements in electrics and cars will be refined and bettered from time to time. Just what these improvements will be, the future will develop.

The establishment of better garage facilities and the increased number of men whose services can be obtained for intelligently taking care of electrics and advising owners in reference to taking care of batteries and operating parts of the car, insure better service of electrics in general, and a constantly increasing number of enthusiastic electric car owners.—FREDERICK A. BRAND—The Broc Electric Vehicle Company, Cleveland, O.

Field Limitless—Henderson

¶ The field of the electric for city and intercity use is practically limitless. Such a statement might have seemed absurd to the minds of most people 3 years ago, but so rapid have been the strides in the development of storage batteries, the manufacturer meanwhile keeping pace in the development of the mechanical parts of the car, that their use in city and suburb 5 years from now will be universal throughout the United States and Canada is a logical conclusion.

One of the most potent factors in promoting the greater popularity of the electric is the fact that the price of current is steadily decreasing, while the cost of gasoline is constantly soaring upwards. The electric at the present time is the most economical means known for city and suburban trackless transportation in both the commercial and pleasure fields. The most notable expression of confidence in the electric truck as an economical and efficient means of transportation is the purchase of the electric truck fleets in enormous quantities by the various express interests of the country. After the most searching investigation and long years of test and try-out, these large transportation interests have adopted the following rule for the introduction of motor equipment. For all city delivery purposes, the electric is used exclusively. For suburban service which involves the long hauls and rough road work the gas truck is being used. Nowhere have the two distinct fields of service for the gas and electric been made more apparent than by the use to which the two types have been put by the express companies.

It is the performance of the cars themselves which has won a greater popularity for the electric as a necessary adjunct to the social activities of the men and women of this country. In the first place its qualities of inherent simplicity and absolute reliability have won the confidence of everybody. The older members of the family who use an electric know that it is a car which is as safe to operate, and even safer, than the old family horse. It has the added advantages that it is no plug and can go as far in a day as one cares to ride.

Charging facilities are readily installed and at no very great expense, so that it is perfectly possible for the purchaser of an electric to take complete care of the car himself, charging apparatus being so designed that it automatically shuts off

when the battery has been given sufficient charge. The electric becoming more universal in the large centers of population has afforded the opportunity to the manufacturers to give a more perfect service to the owners so that nowadays there is scarcely a city of any consequence in the United States which has not complete power facilities and at least one electric service station which renders complete service to a large number of users at a nominal monthly cost. This system relieves the owner of all responsibility for the proper operation of his car.

In conversation the other day with a man who is closely in touch with the development and plans of the larger electric current producers in the country, he made the statement that he confidently looked forward to the time within five or six years when electric power companies would have the principal highways of the United States spotted with power sub-stations at frequent intervals where it would be possible for the electric car tourist to exchange his discharged battery for one freshly charged and proceed on his way. This statement at first sounded to me somewhat highly colored and imaginative, but upon sober second thought I can conjure up no really plausible argument why such a system could not be very actively worked out in the next few years to come to the great profit of all concerned.—O. B. HENDERSON—The Baker Motor Vehicle Company, Cleveland, O.

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Perfect the Batteries—Woodward

¶ A very wide field of usefulness awaits the electric pleasure vehicle, and one which it is ready to meet just as soon as the public wakes up to the modern electric's adaptability to its requirements. When people realize how far an electric car will travel on a charge, how reliable it is, how free from disorders of all sorts, how simple and easily handled, and withal how speedy and efficient under all conditions, the electric pleasure car will quickly come into its own.

City women have always been the largest users of the electric. There is bound to come a still greater demand from this source with a better understanding of the convenience and simplicity of the modern electric car.

Business and professional men are sure to take advantage of the great facility offered by electrics for their trips about the city. There is a tremendous field in this direction when we can overcome the prejudiced belief that the electric is only a woman's car.

At its present stage, selling electrics is largely a matter of education. The public do not know what an electric car of modern design will do, nor how easily it will do it. When they find out, we will not be able to build electrics fast enough.

The future field of the electric pleasure vehicle, outside of the larger cities and towns, will depend largely upon the men who are perfecting the storage battery. With lighter and more powerful batteries, there is almost no limit to the field which the electric vehicle of the future may rightfully claim as its own.—O. J. WOODWARD—Woods Motor Vehicle Company, Chicago, Ill.

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Future Is Bright—Krueger

¶ If the last 20 months can be in any way considered a barometer as to the possible growth of the electric car business, it certainly is destined to become a very important factor in social and industrial life in cities. The field of the electric today is practically confined to cities of 7,500 or above in population, although with the advent of popular-priced cars, the smaller cities have shown a remarkable demand. Cities are now buying cars, where very few if any were in use before. The fact that the prices in some have been reduced, and popular-priced cars have been marketed, opens up a new and undeveloped field in the smaller cities. Of course there is a natural increase that comes with the general increased understanding of electrics, but there are three elements which have probably contributed more to the increase in the electric business than anything else, and they are as follows:

1—The general understanding on the part of the public as to the care and operation of electrics.

2—The decrease in the first cost of electrics.

3—Revisions and improvements in mechanical construction with corresponding increase in efficiency.

The possible field for inter-city use for electrics where the roads are good, and the radius does not exceed 20 miles is almost unlimited. Farmers are booking with the electric for farm-to-city use.—C. F. KRUEGER—Standard Electric Car Company, Jackson, Mich.

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To Be Supreme City Car—Reed

¶ The electric automobile was looked upon by the public as a somewhat expensive toy 5 years ago, a luxury without any well defined place or purpose. Today it occupies a prominent place in industrial and social life.

And its future?—A comprehensive study of the evolution of the electric, the development of public opinion, the growth of distribution and sales, leads the writer to believe that in the future this vehicle is destined to be the supreme city car.

Statistics taken in twenty-five of the largest distributing points in the United States show that out of the total number of electric cars running in these localities, 25 per cent. to 60 per cent. have been sold during the past 15 to 18 months. Everywhere manufacturers and distributors are enthusiastic over the future possibilities of this industry.

The gratifying future of the electric is due to the present success in destroying dangerous prejudices. Until 2 years ago, the general public and a large proportion of the automobile dealers who play a very important part in ultimate distribution, were not acquainted with the tremendous advantages of the electric. They voiced imaginary objections, among which were: "It will not climb hills"; "It will not give enough mileage"; "It has no speed"; "Its cost of maintenance is too high." These charges are disproved by fact and experience.

No better evidence can be given of the ability of electric cars to climb hills than the electrics now running in such cities as Seattle, Cincinnati, Pittsburgh, Kansas City and other towns of similar topography. In these cities 45 per cent. of the total number of cars in operation were sold during the past year. Today the electric motors and batteries used are a vast improvement over the designs of 6 or 8 years ago. Motors are now built to withstand the most severe road conditions, excessive overloading and to perform at a high efficiency above their normal rating.

The modern electric will render an eminently satisfactory mileage. We must remember this vehicle is strictly a convenience and is designed with reference thereto. The designing of an electric for mileage in excess of what is actually required for its purpose is simply wasted.

High speed is obtainable in modern electrics. It will be of interest to the reader to know that the fastest automobile mile, some years ago, was made by an electric. It has the speed and power proportionate to its use and natural service.

The operating cost of a well-equipped electric is considerably less than is usually thought to be the case. There is an economic feature to be considered. It eliminates the necessity of a chauffeur. You have all the convenience and luxuries of a limousine without its attendant expense.

The barriers have been swept away. The electric car is no longer a victim of misunderstanding. When a product has killed prejudice and enlightened public opinion, its future success is assured. The electrically-propelled vehicle has won its first and greatest battle. The next decade will see the electric pleasure car holding unchallenged its position as the ideal city car.—PENROSE REED—Chicago Electric Motor Car Company, Chicago, Ill.

Insurance from the Electric Viewpoint

Rates Recently Cut by Companies As Result of Decreased Liability To Accidents of All Kinds

By Carl H. Clark
Insurance Adjuster

WHEN the matter of insurance of automobiles was first brought out some years ago, it was treated rather lightly by owners, dealers, and even by those insurance companies which did not at that time write it. Conditions at present are, however, far different. There has been a great increase in the number of insurance companies writing it, and an enormous increase in the number of cars insured.

It was once a very common saying that there is nothing about an automobile to burn, but experience has shown both owners and underwriters that cars of all descriptions can and do burn. The saying is therefore rarely heard now, and the insurance of automobiles has become very firmly established. It is almost the exception to see a car of recent make and of some value which is uninsured, and, in fact, so general has insurance become, that cars are offered for insurance continually, which, from their type, age, ownership or other conditions, are not insurable.

While it is not possible to describe in detail within the limits of a short article all of the various forms which the policy may take, the general terms and intent of the policy may be described. The automobile fire policy may be divided into two general classes, namely, (a) the full value form, and (b) the non-valued form. Under the former (a), the value of the car insured is determined and agreed upon when the policy is issued, and remains without reduction during the life of the policy. In the event of the destruction of the car there can be no question as to the amount payable, this being the insured value, without regard to the actual value at the time of the fire. The policy covers against fire in the general sense, arising from any cause whatever, whether external or internal. In case of damage this form of policy allows the replacement of destroyed parts with new without regard to any depreciation from use. Damage to the car while being transported upon any conveyance upon land or water is also provided for, as well as the loss by theft of the car or any of its equipment in excess of $25 in value. The theft clause is also construed to cover damage to the car while in the hands of unauthorized parties. Losses under this clause are very numerous, especially in the large cities; some cases occur where a car disappears completely, and there are frequent cases where cars are recovered in a damaged condition.

In the non-valued form (b), the value of the car and the parts thereof is not stated, but is left to be determined at the time of the loss. Losses are presumably adjusted on the basis of the value at the time of loss, taking account of depreciation. As the automobile is probably the least stable in value of any kind of property, there are naturally some difficulties in determining its value at a particular time. This form of policy does not as a rule carry the theft and transportation features, although custom differs somewhat in different States. The latter form of policy, as might be expected, costs less than the former.

Attached to the fire policy there may be a collision clause, as it is termed, which covers the car against damage sustained by collision with a moving or stationary object. This, again, may appear in two forms, the full coverage, which pays for all claims in full, and the $25 deductible, in which this amount is deducted from each claim. In other words, only the excess over $25 is payable. The latter form is the less expensive, as it has the effect of eliminating a large number of small claims, which would total to a large amount. In some States there may be attached an additional clause covering against collision damage done. This protects the owner of the car against liability for damage done by the car to the property of others, or the property damage.

There is also the liability policy, covering the liability of the owner for personal injuries inflicted on others by the car. This form of policy, as usually written, covers injuries to one person up to the amount of $5,000, and up to $10,000 if two or more persons are injured. These limits may be doubled if desired. The insurance company also pays the cost of defending all suits for damages. The property damage clause above mentioned is very often written in connection with the liability policy, as it is of the same general nature.

With reference to the rates of insurance, those for gasoline cars are figured on a sliding scale, which is based on the age of the car, original price, and amount insured. The rate for electric vehicles is a flat rate. Without quoting figures, it may be said in a general way, that the rate on electric vehicles is about one-half that charged for the gasoline car. Since the rates are based on experience, this may be understood to mean that the losses have been less in proportion than on gasoline cars. In fact, there has been a reduction of the rate on electric cars within the last few months. On the other hand, if with the increased use of electric cars, both for pleasure and business, the losses should proportionately increase, it might be expected that the rate would also increase.

The favorable experience with electric vehicles may be accounted for by several reasons. First, and probably of greatest importance, the nature and construction of the electric render it much less liable to fire than in the gasoline car, where inflammable gasoline is used. The electric is generally used for a certain definite purpose and over short distances, and it is thus less exposed to fire risks, and on this account also it is less likely to be driven by careless or inexperienced persons. On account of its low speed, it is less shaken up, with the consequent loosening of joints and connections. The low speed and the ease with which it can be controlled also make it a favorable proposition as regards the collision and liability insurance.

It may be of interest to note some of the most common causes of fires in electric cars. These seem to fall somewhat naturally into a few definite classes:

The most common cause seems to be the overheating of the resistance coils by the throwing on of the current while the car is at rest. The primary cause is the accidental movement of the control lever after the car has been stopped and the brakes set. Sometimes the control lever is thrown from neutral into the first speed by catching in the sleeve or skirts as the operator is leaving the car. The low-tension current used in the electric car has great heating effect, and the current under the above circumstances soon overheats the resistance coil, causing damage. Cars have been known to travel a few feet unobserved after the current had been accidentally turned on, bringing up against a wall or snowbank, with the same result. Care should be taken in leaving the car to see that the control lever is in neutral, and the plug removed. This latter precaution will in a large degree prevent also the theft of the car.

Engineers View Electric Standardization

ALEXANDER CHURCHWARD, H. H. Rice and E. W. Gough summarize what has been done, and outline some of the things that ought to be accomplished to produce passenger and commercial electrics in conformance with some established basis of uniformity. Mr. Churchward says that to-day standardizing the speed of the electric is the aim. For commercials he believes it should range from 13 miles an hour to 6.5 miles an hour in decreasing ratio to the load capacity. Mr. Rice holds that voltage, batteries, lights and plugs limit the field for uniformity, while Mr. Gough takes the position that parts and equipment of all sorts are susceptible to standardization which is required with more force even than in gasoline practice. He specially points out that electric current distribution is uniform and that the vital parts of car equipment should be harmonized with the established rules.

STANDARDIZATION in the electric pleasure and commercial field is an important factor. I advanced the cause of standardizing voltage of various sizes and types of vehicles 1 year ago, and much progress has been made. Today nearly all of the 1912-13 vehicles will be equipped with batteries the charging voltage of which will be from 78 on the smaller pleasure or passenger cars to 110 on the various sizes of commercial vehicles and the larger types of pleasure or passenger cars.

Today standardizing the speed of the electric vehicle is the aim. The speed of these vehicles has been increased from year to year, and the real cause of this is not that the engineer of any one company has found some new battery, motor or tire, but because the salesman finds it easier to sell a car that will travel faster than that of his nearest competitor. Now the real claim for the electric pleasure vehicle is that it is so simple, reliable and easy to operate that any woman can operate it. But when you stop to consider that one of these glass-inclosed vehicles weighs approximately 1.5 tons with passengers, and is capable in some cases of making 25 miles an hour on good level roads, do you think that the speed is too high for the vehicle to be properly controlled by a woman? I consider 20 miles an hour very fast, yet the braking strain is 56 per cent. greater at 25 miles an hour than at 20. And I have noticed that in many cases the braking mechanism has not been increased in proportion to the increase in the speed of which the vehicle is capable.

I suggest the following speeds as standard for electric pleasure vehicles, and in presenting these would say that I have talked the matter over with the different manufacturers and the following speeds have been selected as an outcome of these conversations:

Closed types, Coupé	Open Victoria types
19 M.P.H. pneumatic tires	20 M.P.H. pneumatic tires
18 M.P.H. solid cushion tires	19 M.P.H. solid cushion tires

In order to determine the amount of electric current consumed by electric vehicles operating at different speeds, I conducted a series of tests and to obtain the desired accuracy attached a special graphic recording instrument to the vehicle which registered simultaneously the amperage and voltage at the motor or battery terminals, depending upon connections made; revolutions of the front wheels and a chronograph-meter attachment so that the time and number of revolutions are recorded. This instrument, in addition to giving the exact reading at any one time, is valuable for making acceleration tests as it shows the variations in volts, amperes and speed during the time required to move the vehicle from rest to full speed. From these tests it is apparent that the power required to drive an electric pleasure vehicle rises very rapidly as the speed is increased over 17 or 18 miles per hour.

It is equally essential in the commercial vehicle field to take recognition of speeds, and I have recently taken this matter up with a number of manufacturers and a compilation of the speeds they suggested for electric commercial vehicles of various capacities is given herewith:

Vehicle Capacity	Speed M.P.H.
1000 Pounds	12 to 13
2000 Pounds	10 to 11
3000 Pounds	10
2 Tons	8 to 9
3 Tons	7 to 8
4 Tons	6.5 to 7.5
5 Tons	6 to 7
6 Tons	6.5

A 3-ton truck, to compete successfully with horses, does not have to run at touring car speeds. The average speed of a 3-ton horse-drawn truck is 2.5 miles per hour, and the mileage not over 12 to 15 per day. Therefore a 3-ton truck running at 7.5 miles per hour will compete very successfully with a horse-drawn vehicle and its maintenance cost will be low. Therefore the maximum speeds must be kept down to such a point that the electric vehicle will continue to hold the enviable position it does today; namely, that for city work and short hauls it is the cheapest and most reliable method of mechanical traction.—ALEXANDER CHURCHWARD, Boston, Mass.

Standardize Voltages—Rice

¶ The standardization of electric pleasure and commercial vehicles has been considered at several meetings of the standardization committee of the Electric Vehicle Association of America.

Standardization is a good thing, but it is, I should say, of necessity, limited in its mechanical side to the adoption of the standard sizes of bolts, nuts, threads, etc., already adopted as standard by the A. L. A. M. and the S. A. E. committees. **Electrical standardization is limited, I believe, to the voltage of motors, batteries, and lights, to the charging plug, and perhaps to the running plug,** provided the car has other means of individual locking, such as a Yale key.

The voltage standard is necessarily regulated by the voltage supplied by the central stations and by the physical properties of the battery. The standard direct voltage is 110 or multiples of it, hence one standard, at least, would be approximately forty to forty-two cells as a maximum number which can be charged from a 110-volt direct current. This would require, naturally, a motor of the same voltage.

For those engineers who feel that the best compromise in designing is to use a smaller number of cells, I think thirty is a good stopping point, and might be standardized, giving the engineer that option. This is a good standard too, because the motor to go with this lead battery voltage could be used with a sixty-cell Edison battery, which is about the highest voltage Edison which can be charged off 110-volt circuit.

If it were thought that other standards were needed where indoor trucks or light pleasure vehicles did not require so much power, still other standards might be set of twenty-four and sixteen cells, the motor voltages for all being correspondingly 80, 60, 48 and 32 volts.

It will be understood, of course, that it would be quite possible to keep the 110-volt standard on a car requiring a

very small battery, but this would make it necessary for the battery people to build very small cells and increase the variety of battery plate and jar sizes to such a number that an attempt to standardize solely on 110 volts would increase the confusion in the batteries.

With Edison, voltage standards would be the same as above, but would, of course, require different number of cells than the lead battery for the corresponding voltage.

The desirability of a standard charging plug and receptacle, so that any make of car could be charged without difficulty, or any make of car in a strange garage when in another part of the city or going across country, is too apparent to need comment.

The running plug or switch key, if not used in combination with a definite lock for protection against meddling, might very well also be standardized, principally for the sake of garages where various makes of cars are stored. This latter, however, is of minor importance, and in fact it would be probably difficult to get uniform adoption of such a key.

Lamps, of a necessity, would be standardized if the battery voltages are standardized, but the standards might and should prescribe certain approved makes of sockets and size of sockets, as for instance, Ediswan candelabra base, so that the owner could readily find globes to fit his lamp.—HERBERT H. RICE—The Waverley Company, Indianapolis, Ind.

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Standardization Is Necessary—Gough

¶ **The necessity for the standardization of parts and equipment of electric vehicles, both pleasure and commercial, is even more apparent than the standardization of gas car apparatus,** now being so admirably conducted by the S. A. E. Each vehicle propelled by a gasoline engine is in a sense independent, provided parts can be obtained from its maker, as fuel, oil, etc., are obtainable almost universally. The electric vehicle, however, must of necessity come back to general charging points, and this in its broadest sense need not be public garages, but eventually they must be charged from common electrical distribution systems.

Since practically all the electrical distribution systems are standardized in this country it is evident that the heart of the electrical vehicle, namely, the battery, should readily adapt itself to this standardized service.

Treating broadly the various elements in the electric vehicle which could be standardized to advantage, I submit the following:

Batteries—The arrangement of the battery should be such that it is easily charged from the ordinary 110 to 115 volt circuit, this voltage being almost universal. To obtain economy it is obvious that the largest number of cells of battery permissible with this charging voltage should be used, otherwise energy is wasted as heat in rheostats, etc.

Charging Apparatus—The charging plug, receptacle and cable should, as far as possible, be uniform. While it may not be possible at this time to adapt a universal charging plug suitable for both small pleasure vehicles and very heavy trucks, it should be possible to cover the entire field with not more than two plugs, etc. Under such an arrangement any garage could care for any make or size of vehicle as far as charging is concerned.

Lamps—The electric lamps should be standardized, particularly as to the base and voltage. The adoption of standard lamps will enormously reduce confusion and disappointments to the owner.

Speeds—The ultimate speed of any electric vehicle, being largely a fixed quantity for a given road and load condition, it would seem highly desirable to standardize for various sizes, capacities, etc., bearing in mind that a vehicle which is too slow may interfere with congested traffic as much as one which is too fast. Much able work has already been done along these lines by the Electric Vehicle Association of America.

Tires—For pleasure vehicle work this subject has already been largely covered by the S. A. E. as the general mounting of the pneumatic tires is the same for both gas and electric vehicles.

For commercial vehicles, however, there has been practically nothing done which could be considered standard. Since the tire has a very great bearing on the electrical energy required from the battery, too much effort cannot be exercised toward the use of a standard tire having high efficiency universally obtainable, easily mounted and easily maintained.

There are many other parts of refinement which can hardly be taken up in detail in this space, such, for example, as the standardization in commercial vehicles of weight ratio to draw bar pull, ratio of weight to capacity, etc.

The electric vehicle industry is only in its infancy, and a few years more will show vast changes in details tending toward standardization of all classes of vehicles and consequent bettering general service.—E. W. GOUGH—General Vehicle Company, Long Island City, N. Y.

What the Distributors Say About the Field

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"A WELL-EQUIPPED centrally located general garage for electric cars would do more to educate the New York public to the advantages of the electric automobile than anything else," said W. R. Chandler, vice-president of the Holt-Chandler Company, handling the Flanders in the metropolitan section. "I favor the selection of a large plot of land in upper Broadway and the erection of an adequate garage building so located that the passing throng shall be able to see cars entering and emerging from the building; cars standing on the floors; cars being charged, all visible through large expanses of plate glass. The fact of the matter is that the New York public knows little about the electric passenger car and what little it thinks it knows is largely erroneous. The actual, physical sight of electrics at the source of power supply would frequently raise the one question in the minds of possible buyers that the electric fraternity wishes to implant: If the electric in use can be handled, run and charged like that; why should not I have one?"

"The electric passenger car is not a rival of its gasoline prototype in the field of touring and distance work," said Nathaniel Platt, sales manager of the Baker Motor Vehicle Company in New York. "It is, however, the best automobile vehicle for suburban work; for service in heavy traffic and for social and individual use where the chauffeur is not required. There are about 2,000 electric automobiles of all sorts in operation in New York, the charging of which is a valuable element in the business of the central stations. The peak of the load usually occurs about 5 o'clock in the afternoon."

"In direct competition with the gasoline car, the electric is now bidding for city and suburban business," said Cloyd Y. Kenworthy, representing Rauch & Lang in New York and vicinity. "The electric is not simply a woman's car. It is an automobile of general usefulness. Physicians are taking it up for professional service and I need not recount the established facts concerning the electric further than to say that if the car is good for the doctor's purposes, the last futile argument against such automobiles disappears."

Electric *for*

GREATER-CAPACITY batteries; longer wheelbases; larger and lower bodies; together with a host of minor improvements mark the difference between the electric passenger vehicle of 1913 and its predecessors. Shaft drive has made some progress, as distinguished from the use of chains or the combination of means for reducing from motor speed in transmission, in connection with final shaft drive.

Taken as a whole, the past year has been the best ever enjoyed in the industry. The total production of electric passenger cars was not far from 6,000 and the demand generally in excess of production.

For 1913 plans have been laid to make about 10,000 cars, and the orders booked since autumn and still unfilled make such a figure look reasonable. The current orders are fully 10 weeks ahead of several of the factories.

The chief tendency to be noted in the electric passenger car field is toward the centralization of effort upon one chassis type, no matter how many body styles are used. This is the same tendency that has been found in current gasoline practice and is in line with the progressive ideas that permeate the whole structure of American manufacturing.

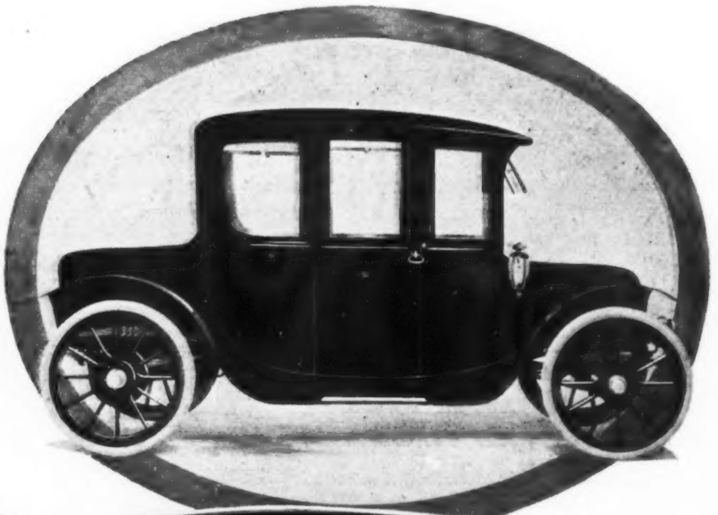
Judging from the changes announced for this year, the most serious fault of electrics generally in the past was lack of power. Last year several of the major manufacturers increased the battery equipment and this year the 40-cell, 11-plate lead battery or the 60 or 64-plate nickel-iron battery have been made standard equipment or first option by the more prominent manufacturers.

In order to use the extra supply of current due to the enlarged batteries, larger motors have been installed. Several companies have substituted 80-volt motors for the 60-volt ones formerly used. It would be inaccurate to say that the average figure is represented by that difference, but in general the 1913 motors are considerably larger than those of 1912.

Electric passenger vehicles keep pace with the gasoline section of the automobile industry according to announcements made by the various factories as to production.

There are twenty-four companies engaged in manufacturing passenger vehicles this year. In 1912 the output was about 6,000 cars, but this year the factories will make 10,000 or more.

Fully 80 per cent. of the 20,000 passenger electrics now in use are distributed west of the Allegheny Mountains, east of the Rockies and

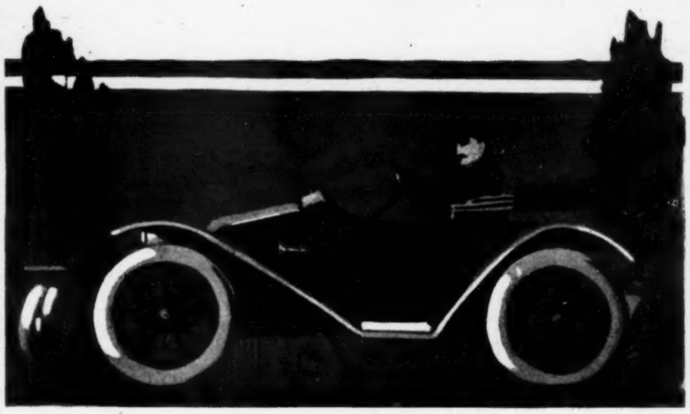


Waverley fore-drive brougham, showing curved lines, model 101, $2,800

Buffalo coupé, model 30, showing wire wheel equipment, price $2,600

Baker brougham, curved roof and graceful body lines, $3,100

Vehicles 1913



north of the Arkansas line. Fifty per cent. of the whole number are in Illinois, Michigan, Ohio and Indiana.

Popular use of the electric is in direct proportion to familiarity with it; therefore the cars have their greatest vogue in and about the cities where they are made.

The chief element in the recent growth of the industry has been the active co-operation of the central stations.

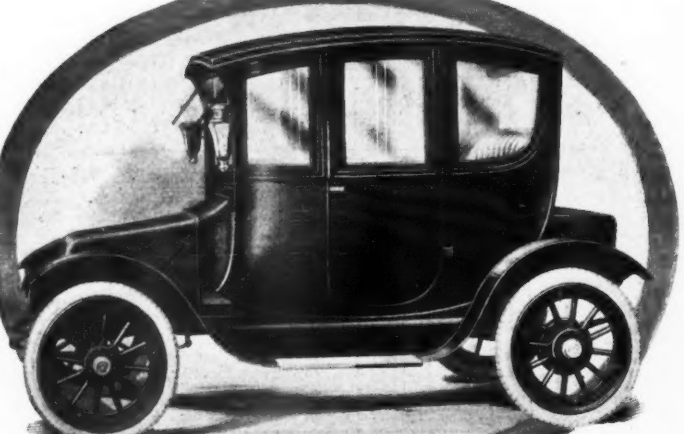
The object of increasing the capacity of the battery and motor is to afford more mileage and the effect may be traced in the largely increased figures in estimated miles per charge. Last year the average claimed mileage was around 70 per charge, with actual performance below that figure due to the difference between general operation on all kinds of pavements and under all sorts of conditions and the expert operation of the skilled driver on smooth pavements. The claims for 1913 range above 75 miles to the charge. Some of the large, prominent companies are chary on mileage claims, and the lower figures on estimated mileage come from concerns that in the past have exceeded advertised figures in real service of their cars.

Deducing from the list of specifications herewith, the 100-mile electric has arrived. That maximum mileage is claimed for certain models by fourteen out of the twenty-four makes tabulated. Naturally, such an extraordinary mileage cannot be delivered under all conditions of road and weather.

The transmission of power from the motor to the rear road wheels has been the subject of much development work during the year, although actual changes have not been so radical as those that were noted in 1912. Shaft drive has made some progress. Two-thirds of the passenger vehicles are fitted with it, using either the straight-shaft principle or speed reductions between the motor and the propeller shaft. Only two retain chain drive. The final drive in all cases but the two using chains is through bevel spurs or worm gears in the rear axle.

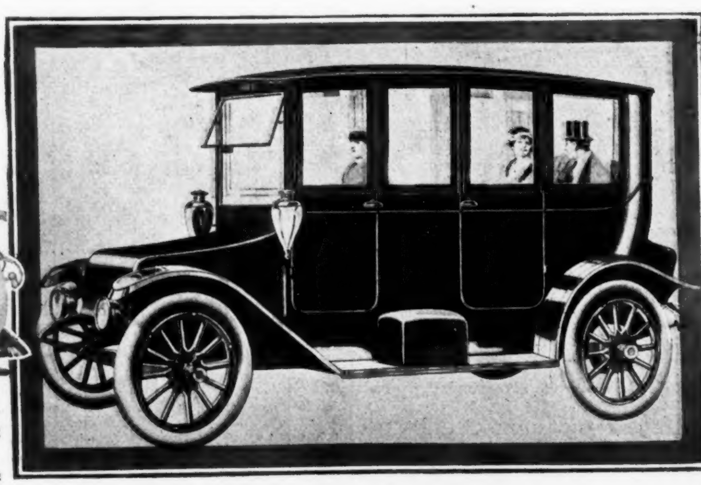
Early in the industry chain drive was used universally and the change to shaft drive or some of its modifications and variations has been accomplished largely within the past 3 years.

During 1912, two companies abandoned silent-chain reduction between motor and propeller shaft to adopt the straight shaft-drive principle. Two more chain-using companies dropped out of competition and those who were added to the industry



Rauch & Lang coach, model J, price $3,100, showing typical construction and graceful appearance given to body design in current practice

Woods, five-passenger, fore-drive brougham, $3,600—one of the characteristic electric passenger types that have been developed during the past year



Detroit limousine equipped with 60-cell Edison battery, $5,000

during the past year have taken up the single reduction shaft-drive idea with one exception.

In that view of the case, the conclusion is palpable that the shaft-drive idea is still being developed and that few accessions are being made to the ranks of those who use the chains.

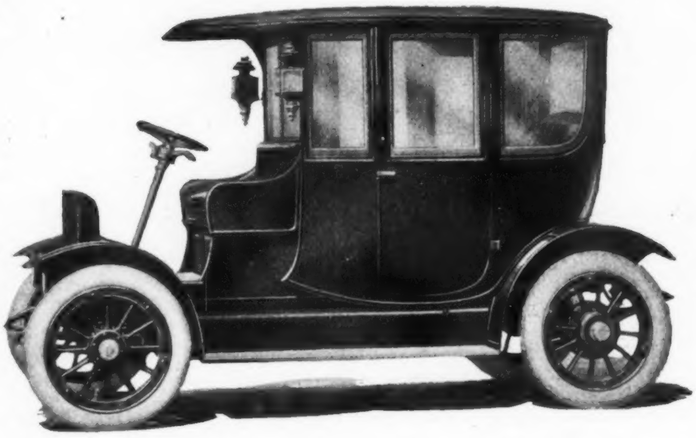
Considerable variety still exists in the question of transmitting power from the motor to the rear axle. The majority of the companies locate the motor approximately midway of the axles. There are three concerns in which the motor is considered a unit with the rear axle, these being Hupp-Yeats, Argo and Flanders. In these three there is neither shaft transmission nor chain transmission, but a single reduction between the motor shaft and the differential.

In the Flanders there is a worm-gear reduction between the motor and the differential. The worm is located beneath the worm wheel mounted on the differential, and revolves in a bath of oil. The worm is forged integrally with the armature shaft, the armature being wound on a sleeve keyed to the shaft, thereby doing away with universal joints or connections.

In the Hupp-Yeats the motor is mounted as a unit with the axle and there is a single reduction through bevel gears.

Coming next to those makers which use a propeller shaft in the accepted sense of the term, and locate the motor approximately underneath the center of the vehicle, there are two classes, namely, those that have but a single reduction between the motor and road wheels and those that have two reductions. Where two reductions are used it is generally customary to make one between the motor and the propeller shaft or countershaft and the second one where the propeller shaft transmits by bevel or worm drive to the rear axle. There are some companies which have two reductions in the rear axle and none between the motor and the propeller shaft. There are some concerns that use one or two universal joints in the propeller shaft and others who do not use a single joint.

In the Detroit there is but a single reduction between the motor and rear axle, this being between the bevel pinion and the differential, which is a 5-to-1 ratio. This company uses a univer-



Rauch & Lang town-car, outside drive model, price $2,800.

Specifications of American Electric Passenger Cars for 1913

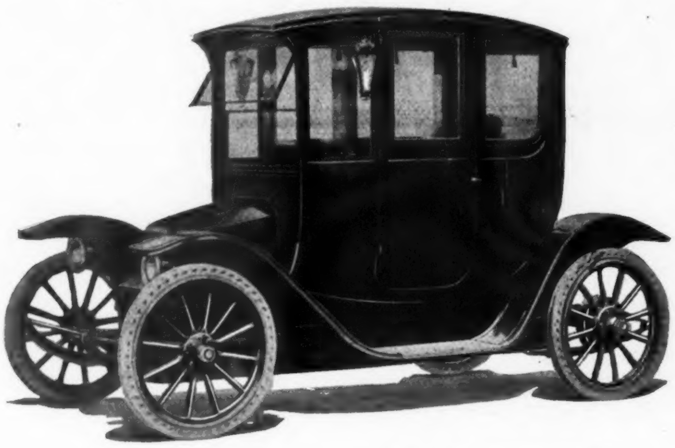
Name and Model	Body Style	Price	Seats	Wheel-base	TIRES			BATTERY			Make of Motor	Final Drive	No For'd Speeds
					Kind	Front	Rear	Make and Number of Cells	Amp.-Hr. Cap'ty	Mileage per Charge			
Argo, B	Roadster	$2500	4	108	Optional	Optional	Optional	Exide 40	135	75-100	Westinghouse	Bevel	5
Argo, A	Brougham	2800	4	108	Optional	Optional	Optional	Exide 40	135	75-100	Westinghouse	Bevel	5
Argo, Fore Drive	Limousine	3250	5	110	Optional	Optional	Optional	Exide 40	135	75	Westinghouse	Bevel	5
Bailey, Roadster	Roadster	2500	2	106	Pneumatic	32x3½	33x4	Edison 52	225	90-100	Gen. Electric	Chain	6
Bailey, Victoria Phaeton	Queen Victoria	2600	3	82	Pneumatic	34x3½	34x3½	Edison 54	150	75-90	Gen. Electric	Chain	4
Baker, V-A	Coupe	2800	4	88	Pneumatic	32x4	32x4	Exide 32	130	65-100	Gen. Electric	Bevel	6
Baker	Brougham	3100	5	92	Pneumatic	34x4	34x4½	Exide 42	140	65-100	Gen. Electric	Bevel	6
Baker	Victoria	2000	2	·80	Pneumatic	32x3½	32x3½	Exide 28	128	65-100	Gen. Electric	Bevel	6
Borland, L	Colonial	2500	5	96	Optional	34x4	34x4	Exide 40	112	75	Gen. Electric	Bevel	......
Borland, LI	Colonial	2500	3	96	Optional	34x4	34x4	Exide 40	112	75	Gen. Electric	Bevel	......
Borland, 41	Brougham	2500	5	93	Solid	32x4	32x4	Exide 40	116	60	Gen. Electric	Chain	6
Borland, 45	Colonial	2700	5	93	Optional	32x4	34x4	Exide 40	116	60	Gen. Electric	Chain	6
Borland, 60	Limousine	5500	7	123	Pneumatic	36x5	36x5	Exide 44	240	100	Gen. Electric	Chain	6
Broc, 20	Stanhope	2100	2	84	Optional	Optional	Optional	Exide 28	135	75	Westinghouse	Bevel	5
Broc, 28	Brougham	3000	5	96	Optional	Optional	Optional	Exide 40	135	90	Westinghouse	Bevel	5
Broc, 29	Brougham	3100	5	96	Optional	Optional	Optional	Exide 40	135	90	Westinghouse	Bevel	5
Broc 31, Fore Drive	Brougham	3500	5	96	Optional	Optional	Optional	Exide 40	135	90	Westinghouse	Bevel	5
Buffalo, 29	Roadster	2600	2	100	Pneumatic	34x4½	34x4½	Phila. 42	140	50	Diehl	Bevel	4
Buffalo, 30	Coupe	2600	4	100	Pneumatic	34x4½	34x4½	Phila. 42	140	50	Diehl	Bevel	4
Century, B	Brougham	2550	5	98	Optional	Optional	Optional	Exide 36	150	65-100	Westinghouse	Bevel	6
Chicago, 131	Coupe	2800	5	96	Cushion	36x4½	36x4½	Exide 40	140	100	Westinghouse	Bevel	5
Chicago, 132	Limousine	3100	5	104	Cushion	36x4½	36x4½	Exide 40	140	95	Westinghouse	Bevel	5
Church-Field, B-R	Torpedo	2300	2	100	Optional	36x4	36x4	Phila. 26	216	75	Wagner	Bevel	10
Church-Field, B-C	Coupe	2800	5	100	Optional	36x4	36x4	Phila. 24	230	75	Wagner	Bevel	10
Colonial, A	Coupe	2700	4	96	Optional	Optional	Optional	Willard 40	160	70	Westinghouse	Bevel	6
Columbus, 1250	Coupe	......	4	100	Optional	36x4	36x4	Exide 40	135	60-80	Gen. Electric	Bevel	6
Columbus, 1230	Coupe	......	4	86	Optional	34x4	34x4	Exide 35	135	60-80	Gen. Electric	Bevel	6
Columbus, 1218	Roadster	......	2	92	Optional	34x4	34x4	Exide 36	135	60-80	Gen. Electric	Bevel	6
Columbus, 1220	Coupe	......	4	92	Optional	34x4	34x4	Exide 36	135	60-80	Gen. Electric	Bevel	6
Columbus, 1204	Coupe	......	4	86	Optional	34x4	34x4	Exide 35	135	60-80	Gen. Electric	Bevel	6
Columbus, 1234	Coupe	......	4	92	Optional	34x4	34x4½	Exide 42	135	60-80	Gen. Electric	Bevel	6
Detroit, 40	Victoria	2300	3	85	Optional	....	....	Optional	140	65-100	Own	Bevel	5
Detroit, 39	Roadster	2350	2	96	Optional	....	....	Optional	140	65-100	Own	Bevel	5
Detroit, 38	Coupe	2600	3	96	Optional	....	....	Optional	140	65-100	Own	Bevel	5
Detorit, 36	Brougham	2700	4	85	Optional	....	....	Optional	140	65-100	Own	Bevel	5
Detroit, 35	Brougham	2850	4	90	Optional	....	....	Optional	140	65-100	Own	Bevel	5
Detroit, 42	Brougham	3000	5	96	Optoinal	....	....	Optional	140	65-100	Own	Bevel	5
Detroit, 37	Brougham	3600	5	104	Optional	....	....	Optional	140	50-85	Own	Bevel	5
Detroit, 41	Limousine	5000	7	112	Pneumatic	34x5	34x5	Edison 60	225	50-75	Own	Bevel	5

Note—Bevel, shaft drive with bevel gear reduction in rear axle; worm, shaft drive with worm gear reduction.

sal joint in the propeller shaft immediately in rear of the motor. the Detroit is what is termed direct shaft drive, as understood in the gasoline field. True, it has the single rear axle reduction which all shaft-driven vehicles have.

The new Chicago electric is shaft drive with a single reduction in the rear axle, where the ratio is 5 1-13 to 1. In the shaft there are two universal joints, one immediately in the rear of the motor and the second just in advance of the rear axle.

The Buffalo electrics are direct shaft with rear axle reduction



Church-Field colonial, showing graceful design, $2,800

of 4 to 1. This concern uses a three-point motor suspension system and employs a ball-and-socket joint which does away with the necessity for universal joints in the propeller shaft. In combination with a ball-and-socket joint are two trunnions, one on each side of the motor, which arrangement gives the necessary flexibility.

The Grinnell, although originally employing silent-chain reduction between the motor and propeller shaft, is discontinuing this feature and using shaft drive with single reduction in the axle. The reduction between the drive shaft and rear axle is 4 1-4 to 1.

The Ohio uses direct shaft with single reduction by bevel pinion in the rear axle, the reduction ratio being 4 to 1.

Universal joints are not used in the propeller shaft. This is accomplished by having the armature of the motor a hollow sleeve mounted on annular bearings and the propeller shaft passes through this sleeve and engages the forward part by a square end. End play and side swing are taken care of by a ball-and-socket joint incorporated in a yoke swung from the frame at its intersection with the torsion rod immediately in rear of the motor.

The Columbus electric uses two reductions, one by silent chain from the forward end of the motor to the propeller shaft and a bevel gear reduction in the rear axle. The propeller shaft has two universal joints. The silent-chain reduction is from a sprocket with nineteen teeth on the armature shaft to one with sixty-five on the propeller shaft, and the rear axle reduction is from a fifteen-tooth pinion to a fifty-one-tooth gear. The

Specifications of American Electric Passenger Cars for 1913

Name and Model	Body Style	Price	Seats	Wheel-base	TIRES			BATTERY			Make of Motor	Final Drive	No. For'd Speeds
					Kind	Front	Rear	Make and Number of Cells	Amp.-Hr. Cap'ty	Mileage per Charge			
Electra, C	Roadster	$ 750	2	90	Optional	30x3	30x3	Haschke 20	150–175	75–100	Own	Bevel	4
Dayton, 112	Coupe	2600	4	86	Pneumatic	33x4	33x4	Exide 30	147	75–100	Westinghouse	Bevel	5
Flanders	Victoria	2200	4	100	Pneumatic	33x4	33x4	Own 30	135	75–100	Timmerman	Worm	6
Flanders	Colonial	2500	5	100	Pneumatic	33x4	33x4	Own 30	135	75–100	Timmerman	Worm	6
Fritchle	Brougham	3600	5	86	Optional	34x3½	34x3½	Own 32	140	100	Own	Bevel	5
Fritchle	Coupe	3000	4	88	Optional	34x3½	34x3½	Own 32	140	100	Own	Bevel	5
Fritchle	Runabout	2400	2	88	Optional	34x3½	34x3½	Owen 32	140	100	Own	Bevel	5
Fritchle	Roadster	2500	4	88	Optional	34x3½	34x3½	Own 32	140	100	Own	Bevel	5
Grinnell, M	Coupe	2800	5	94	Cushion	34x4	34x4	Optional	180	100	Westinghouse	Bevel	5
Grinnell, K	Coupe	2950	5	96	Cushion	34x4	34x4	Optional	185	85	Westinghouse	Bevel	5
Hupp-Yeats, Regent	Coupe	1750	4	86	Pneumatic	33x4	33x4	Exide 27	135	75	Westinghouse	Bevel	5
Ohio, O	Semi-Col., Br'gh.	2900	5	96	Optional	33x4	33x4	Exide 40	160	100	Crock.-Wh'l.	Bevel	5
Ohio, L	Col. Brougham	3200	5	96	Optional	33x4	33x4	Exide 40	160	100	Crock.-Wh'l.	Bevel	5
Ohio, M	Brougham	3200	5	96	Optional	33x4	33x4	Exide 40	160	100	Crock.-Wh'l.	Bevel	5
Ohio, Y	Semi-Col., Br'ghm.	3500	5	96	Optional	33x4	33x4	Exide 40	160	100	Crock.-Wh'l.	Bevel	5
Phipps	Coupe	2500	5	107	Optional	36x4	36x4	Exide 40	165	75–100	Westinghouse	Bevel	5
Rauch & Lang, R-545	Roadster	2600	2	92½	Optional	Optional	Optional	Exide 40	138	50	Hertner	Bevel	6
Rauch & Lang, CR-545	Enclosed Roadster	2800	2	92½	Optional	Optional	Optional	Exide 40	138	50	Hertner	Bevel	6
Rauch & Lang, DB-525	Demi-Brougham	2800	4	......	Optional	Optional	Optional	Exide 40	138	50	Hertner	Bevel	6
Rauch & Lang, BB-545	Standard Brough.	2900	4	92½	Optional	Optional	Optional	Exide 40	138	50	Hertner	Bevel	6
Rauch & Lang, CC-545	Col. Brougham	2900	4	92½	Optional	Optional	Optional	Exide 40	138	50	Hertner	Bevel	6
Rauch & Lang, T-545	Brougham	3000	5	92½	Optional	Optional	Optional	Exide 40	138	50	Hertner	Bevel	6
Rauch & Lang, J-545	Brougham	3100	5	103	Optional	Optional	Optional	Exide 40	138	50	Hetrner	Bevel	6
Standard, M	Coupe	1885	4	96	Pneumatic	32x3½	33x4	Exide 30	138	75–100	Westinghouse	Bevel	6
Waverley, 90	Roadster	2250	3	104	Cushion	Optional	Optional	Optional 34	138	75	Own	Bevel	5
Waverley, 97	Brougham	2375	4	104	Pneumatic	33x4	33x4	Optional 40	138	75	Own	Bevel	4
Waverley, 101	Brougham	2800	4	106	Cushion	Optional	Optional	Optional 40	138	75	Own	Bevel	4
Waverley, 100	Limousine	2900	4	106	Cushion	Optional	Optional	Optional 40	138	75	Own	Bevel	4
Waverley, 99	Brougham	3250	4	109	Optional	Optional	Optional	Optional 40	138	75	Own	Bevel	4
Waverley, 98	Limousine	3500	5	109	Optional	Optional	Optional	Optional 40	138	75	Own	Bevel	4
Woods, 1320	Roadster	2400	2	92	Solid	32x2½	34x2½	Exide 40	140	80	Own	Bevel	5
Woods, 1319	Victoria	2500	4	92	Solid	32x2½	34x2½	Exide 40	140	80	Own	Bevel	5
Woods, 1321	Brougham	2700	5	92	Solid	32x3½	34x2½	Exide 40	140	80	Own	Bevel	5
Woods, 1317	Brougham	2700	4	92	Cushion	32x2½	34x2½	Exide 40	140	80	Own	Bevel	5
Woods, 1323	Brougham	3100	5	92	Cushion	34x3½	38x4½	Exide 40	140	80	Own	Bevel	5
Woods, 1322	Brougham	3600	5	102	Solid	36x4	40x4	Own 42	140	80	Own	Bevel	5

Note—Bevel, shaft drive with bevel gear reduction in rear axle; worm, shaft drive with worm gear reduction.

total reduction between the motor and rear wheels is 11.6 to 1.

The Century is shaft-drive with 4-to-1 bevel-gear reduction in the axle. There is only one universal joint, which is located in rear of the motor.

The Waverley has a characteristic shaft-drive arrangement in that the shaft parallels the rear axle. There is a silent-chain reduction between the motor and propeller shaft of 1.76 to 1, and there is a second reduction in the rear axle by herring-bone gear of 4 to 1. The propeller shaft has two universals.

The Bailey, an example of side chain-drive, transmits from the motor to the jackshaft by chain and from the shaft to the rear wheels by side chains. The reduction between the motor and jackshaft is from twenty-one or twenty-three teeth on the armature sprocket to eighty-seven teeth on the jackshaft. The reduction between the jackshaft sprockets and the rear wheel sprockets is twenty-four teeth to fifty-seven. This gives a total reduction of 9.84 to 1 and 8.99 to 1, the difference in ratio being due to the different number of teeth on the armature sprockets.

Woods uses a shaft drive with double reduction. There is a reduction by herring-bone gear between the motor and propeller shaft and a second reduction in the bevel transmission at the rear axle.

The Rauch & Lang uses shaft drive with double reduction. Reduction No. 1 between the motor and propeller shaft by silent-chain drive is 2 11-28 to 1 and at the rear axle by bevel gear 3 6-13 to 1.

In the Baker chassis the shaft drive is combined with two reductions, the first by silent chain between the motor and propeller shaft and the second by bevel gear in the rear axle. The total reduction amounts to about 10 to 1, but varies in the different models between 9 to 1 and 11 to 1 in connection with a high speed motor, the difference being in the chain reduction.

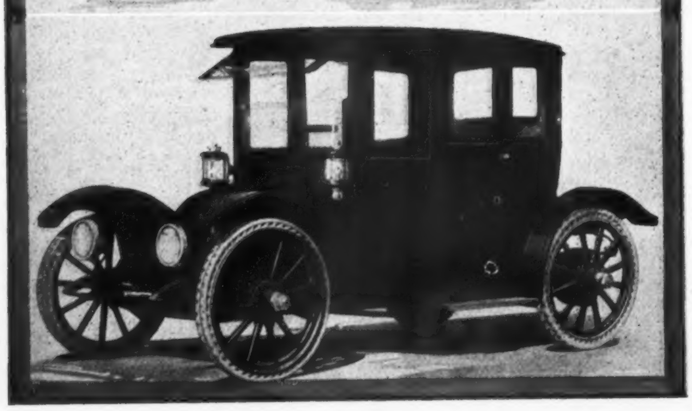
The Broc uses silent-chain and bevel-gear reduction, the former between the motor and propeller shaft and the latter in the rear axle. These reductions are: silent chain 37 to 21 and bevel pinion 4 to 1.

The Standard uses a direct drive without universal joints, and has a double reduction in the rear axle, the first reduction by bevel, the second by spur gears.

It is to be regretted that it is impossible to give the exact methods of reduction, whether double or single employed on one or two of the other cars.

The newcomers this year are the Buffalo, which succeeds the Babcock; the Chicago, Electra and Phipps. Those which have withdrawn are the Babcock, Studebaker, Brunn and several of the small makers. Three of the four new companies use straight shaft drive and those that withdrew used chains either in the regular equipment or as an option.

In the matter of wheelbase there is a decided tendency toward increase. Last year the average wheelbase was a trifle over 90 inches. This has been increased an average of 6 inches,



Fritchle brougham with body designed for family use, $3,600
Grinnell clear-vision brougham, showing long windshield, $2,950
Rauch & Lang brougham, model BB, five-passenger, $2,900
Argo, model A, four-passenger brougham, with curved hood, $2,800

Standard, model M, deep extension and U panel door, $1,885

but the bald statement does not tell the whole truth. By averaging all the 1913 models, the figure appears to be accurate, but it should be less than 96 inches, using the whole production as a basis because the most popular models are not those that are represented by extremely long wheelbases. A more exact figure would be about 94 inches. As a rule, the model upon which the manufacturer has put forth the most effort is the one that most closely approximates the average figure in his line.

The reason for lengthening the wheelbase of the electric passenger vehicle is to provide greater luxury and comfort as well as to provide more space for mechanical developments. This points first to enlargement of bodies and the increased size of passenger compartments in the inclosed cars. In several of the makes, notably Rauch & Lang, Detroit, Waverley, Baker and Woods, some of the bodies are materially larger than they were last year. The drop-frame emphasized in Woods construction lends itself to more room inside and more latitude in seating arrangements.

The additional wheelbase means that nearly all the manufacturers have cars with seating accommodations for five or more passengers, which would have been uncomfortable without the extra inches that have been added.

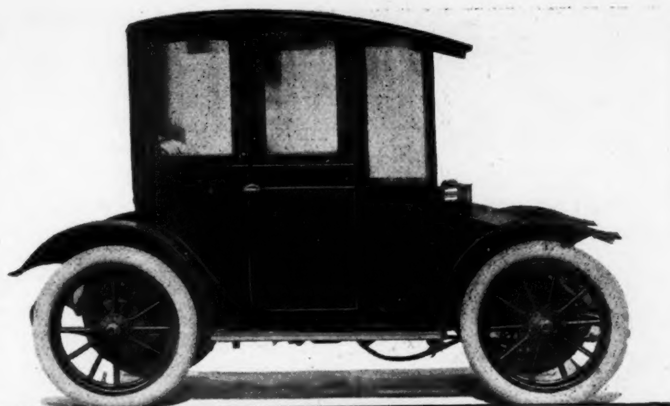
Despite this general enlargement of bodies, the cars of 1913 do not have a top-heavy appearance. This is due to a certain extent to the lowering of the bodies, but to a much larger extent to the art of the body builder who has striven to do his work in such a way that while the actual additional space is used in length, height and width, the visual impression is not that of increased size. Naturally, in order to be harmonious, some appearance of increase might be expected from the actual increase in chassis length, but that impression is not given by the cars themselves.

The fore-drive idea which developed rather suddenly last year has made some progress in the current models. Almost all the leaders have one or more models embodying this idea.

Colonial coupé bodies, embodying the type of body structure and fittings associated with the term, are continued for 1913 by the companies that introduced them heretofore. The colonial idea in body construction is worked out in a variety of ways in the brougham types. Curved lines in the tops are used more frequently this season. This is the same tendency that has been noted in gasoline automobile bodies of high class, but it is still uncommon.

The roof of the extreme type of the curved-top body is the arc of a circle having a radius of about 50 feet. This type is more frequently used with cars of low suspension.

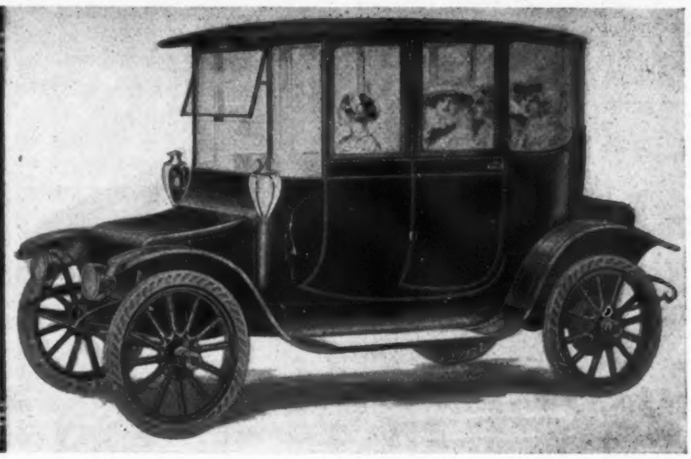
The elimination of sharp angles in body work is quite a feature. While a few models are equipped with bodies, the exterior outlines of which show no angles, being rounded in the rear, front and sides where the roof joins the sides; with



Hupp-Yeats Regent, upon which makers centered effort, $1,750
Columbus brougham with curved roof and arched door sashes
Waverley colonial brougham embodying numerous improvements
Ohio fore-door car designed for social service, $2,900

Chicago brougham model, showing appearance of arched door, $2,800

Detroit clear-vision fore-drive model in city and suburban type

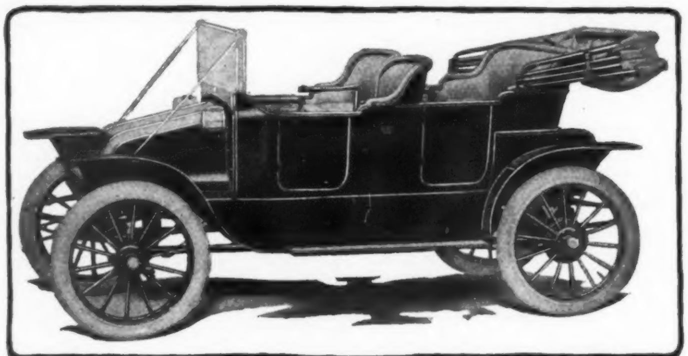


Detroit brougham, showing windows in rear corner panels, $3,600

curved roof and rounded rear, such practice is not to be regarded as representing a standard type. Some one or two elements of the non-angular type are used in a majority of the bodies. Rounded corners at the junction of the rear and side panels is all but universal and the elimination of angles in the lower rear portions is steadily growing in popularity. Upholstery is of neutral-tinted whipcord in the highest-priced cars.

Improvements in the fittings for windows have been made in several important lines of manufacture. These consist of fastenings and frames to check the tendency to rattle and to facilitate raising and lowering.

Open-bodied types of electric passenger vehicles developed only slowly during 1912. The roadster type is continued and the victoria and phaeton are in demand, but the high-pressure business has been done in the inclosed cars.



Fritchle roadster, four-passenger, with large battery capacity, $2,500

Bailey victoria-phaeton, similar to 1912 model, $2,600

All over the country the effort has been made to bring out prominently the service of the electric towncar, brougham, coupé and limousine as a supplement to gasoline equipment or as a substitute for it. The immediate effect of this campaign is to be seen in New York, which up to now has been a regrettably poor market for the electric. During 1912 the dealers in the metropolis disposed of about 200 cars, and as nearly as can be estimated half of the sales were to persons already owning gasoline automobiles, or who had owned them in the past. As the electric lends itself readily to feminine handling and is peculiarly available for service in the city, the conclusion is that the women of the family use the electric for town service. This alone is sufficient to warrant the emphasis laid on the inclosed car by the manufacturers and it also accounts for the general lukewarmness toward the open cars.

Equalizing the weight carried by each axle, and in some cases, the apportionment of load to each of the four wheels has occupied some attention by designers and engineers during the past year. The tendency is growing toward equalizing the load between the axles and the division of the battery is more generally made than last year. It used to be considered good practice to place the battery between the axles, but the washing of the electrolyte and the extra strain imposed upon the frame were two definite disadvantages about such arrangements and now the accepted idea is to make each wheel carry an equal load. This is accomplished in various ways to meet the ideas of the engineers.

One of the practical effects of the redistribution of load is to be seen in the improved spring equipment that has been developed within the past 2 years. Another is in the increased mileage delivered by the tires. The tire companies have gradually extended their mileage guarantees under the influence of the intelligent revision of the load. Today several of the tire companies guarantee 10,000 miles for their tires.

In the line of minor improvements every manufacturer has added something to the 1912 models. Broadly speaking, every improvement that has been made is patented. This applies to the signal device installed in the new Rauch & Lang cars to warn the operator when the current still flows after the car has been stopped and the foot brake applied; to the body designs of the Waverley product, as well as other concerns; to the new rain-vision shield and numerous other details. No radical, basic patented devices were developed in 1912. They were all matters of detail.

The subject of tires is one of the most important in motoring generally. Tires for electric pleasure vehicles depend largely upon the locality where used. Solids can be used where vibration is minimized; cushions have a wider field. There is a wide variation between the solid dual-tread tires used on some of the Woods models and the new MacNaul pneumatic furnished with the Rauch & Lang line.

The Motz tire is in general demand. The new tires placed on the market this year are few. The Woods solid is one of them. This tire is made by the Firestone company and is in effect a cushion. The base of the tire is no wider than the standard rim, but it is divided longitudinally around the circumference so that there are two surfaces bearing upon the pavement. This gives

something the effect of a non-skid tread. The cushion clincher, made by the same company, is simply a cushion tire made in such form as will fit a clincher rim. The side-wire tire is what its name implies. All are guaranteed for 10,000 miles, limited to 2 years' service. Goodyear, Goodrich, United States, Republic and other companies make electric pneumatics the same as in former years. The MacNaul tire is the most radical development of 1913. This tire is oval in shape and has a tread 7-8 inch thick. It is of the ordinary pneumatic type in some respects, but requires an air pressure of but 50 pounds to the inch to give its best service. The guarantee is for 6,000 miles.

The question of speed enters into the situation this year more than ever before. This is due to the increased possibilities for speed in the 1913 cars. The tire makers have united in limiting the effect of their guarantee to the use of their tires at an outside limit of 20 miles an hour. It has been only a short time since the first electric, equipped with a closed body and not intended specially for racing could make 20 miles an hour, but this year any of the stock cars can touch that rate of speed, and some of them can exceed it.

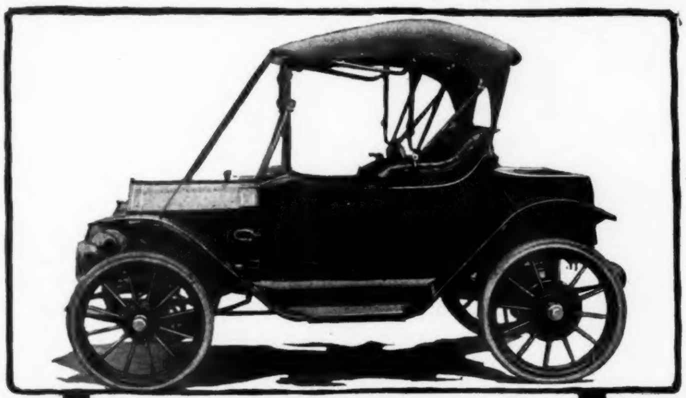
Little change from last year is to be noted in the matter of steering gear. The wheel is used almost exclusively for the outside drive cars, although there are some exceptions. The wheel is also used in some of the fore-drive models, but lever steer is still the prevailing practice in a majority of models. The large companies either make cars with both types of steering gear or will furnish either optionally.

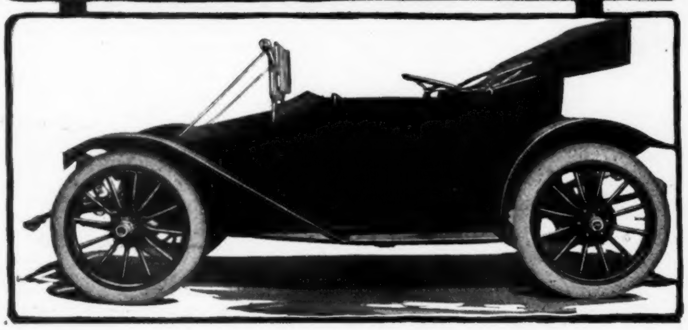
Two changes from magnetic to mechanical brakes appear among the 1913 cars as compared with those of 1912, and one has substituted the magnetic brake for the type formerly used.

The average price of the electric is $2,800. The range extends from under $2,000 to over $5,000. On a strict basis of comparison with the cars of last year, model for model, the 1913 price is higher by about $150 per car. But the story told by averages is incomplete. In 1913 there are fewer cars selling under $2,000 but more at $2,500 or less. At the same time those selling from $3,600 up have increased in number of models. The medium-priced cars are lower in price than last year, but the comparison should not end there. In the same price class as 1912, the 1913 cars offer much more value. They are larger, more powerful and more luxuriously fitted. In other words, where prices have not been slightly reduced, more value is offered for the customer's dollar than before. Thus while the average price for 1913 is higher, it is due more to the elimination of some of the cheaper cars than to a raise all around.

One of the most interesting announcements made this season is that of the Anderson Electric Car Company that its models for the next 3 years will not show any material change from the current offerings. This indicates that in the opinion of one prominent manufacturer at least the present type of electric automobile has a degree of permanence. If this conclusion should prove to be correct and well based the future of the electric will be limited only to its development. If the main principles of the electric are now well-established, the manufacturers can devote more energy to details and to the enlargement of their market.

Following is a brief outline of the various lines of manufacture noting the changes made in comparison with former years:



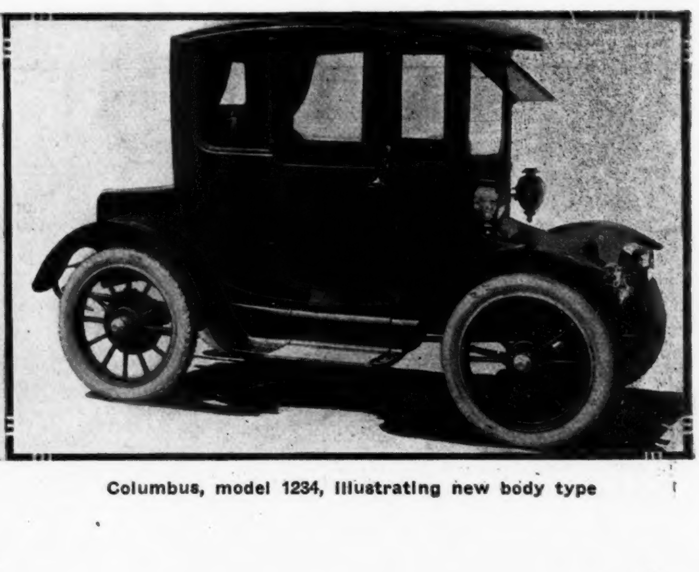


Woods roadster, model 1320, price $2,400
Argo torpedo, which might be taken for gasoline car, $2,500

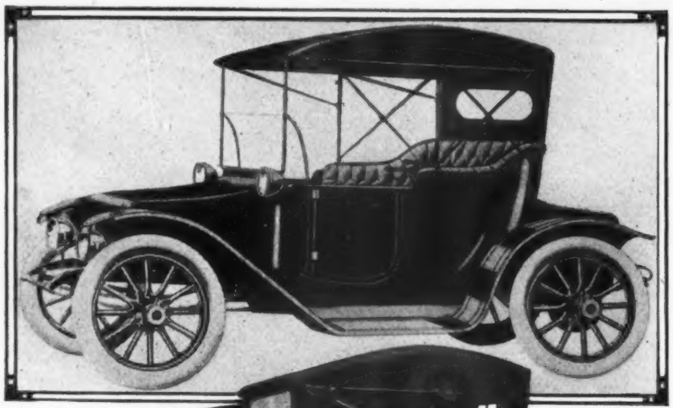
Argo

Three models are presented for 1913, two of which are new. These are a roadster and a fore-drive limousine. The roadster model has a passenger capacity of four and is equipped with a forty-cell Exide battery designed to give a speed of 25 miles an hour. All the Argo models are shaft driven, using two reductions, the first being by herringbone gear at 2 to 1, located between the motor and propellershaft and the second through bevel gears at 4 to 1 between the propellershaft and the rear wheels. The batteries are 33 1-3 per cent. larger than in 1912 and the estimated mileage of the roadster is given as 100 miles on a single charge, while those of the limousine and brougham are placed at 85 miles. The tire sizes are 38 by 4 and 36 by 4 inches for the front and rear wheels, respectively, and the tire equip-

Ohio, four-passenger car, with only one straight line, $3,200



Columbus, model 1234, illustrating new body type



Detroit roadster, with adjustable top and windshield, $2,350
Rauch & Lang roadster, showing different phase of same idea, $2,600

ment is pneumatic, although certain options are offered. Aside from the increased size of the batteries, the chief changes for 1913 consist of improved support for the motor; detailed refinements in body and fender design and added luxury in upholstery and equipment.

Baker

The Baker line is equipped throughout with bevel-gear, rear axles and shaft drive, using silent-chain reduction from the motor to the countershaft. The line offered includes a victoria, colonial brougham and extension brougham. Two extension coupé types are continued. The extension brougham is fitted with seats all facing forward and is a five-passenger car design for family, social and theater work. It embodies all the established Baker features of sumptuousness and is in the high-price class. The passenger compartment has been enlarged and is now 75 inches from glass to glass. The wheelbase of this model is 107 inches. The car has a battery of forty-two cells. Wheel steer is used on this model. The regular Baker brougham has a wheelbase of 92 inches with the same battery equipment as the longer car. Special emphasis is laid on the completeness of the equipment furnished with these cars, which includes besides the full lighting outfit a set of recording and measuring instruments, tools, flower vase and toilet set.

Bailey

Changes in the Bailey vehicles consist in lengthening the wheelbase of the phaeton model from 81 to 82 inches to give a little more ease to its riding qualities. The long roadster presented last year has not been continued. An option of cushion tires is offered with the phaeton model. Chain drive is retained, Morse silent chains being used to the countershaft and roller chains to the rear-axle sprockets, the reductions being 9.84 to 1 and 8.99 to 1, respectively, for the two chassis.

Borland-Grannis

An outside-drive coupé, equipped with an Exide battery of forty-four cells, with a maximum speed estimated at 25 miles an hour, is the feature of the Borland line. The wheelbase has been lengthened 4 inches to 96 inches in the new models and for the particular model, pneumatic tires are furnished. The cars have six forward speeds, and this model has an estimated mileage of 100 per charge. The three other types offered include a roadster with similar battery equipment; a colonial coupé and brougham with forty-cell batteries. The drive is by shaft with silent-chain reduction. The coupé is equipped with a steering wheel.

Broc

Longer wheelbase in the standard models, improvements in the passenger compartments of the inclosed cars, a forty-cell battery in all the larger cars, and 4-inch drop frames to compensate for the enlargement of the bodies are the chief variants in the 1913 Broc line of manufacture. The open types are fitted on chassis with wheelbase of 84 inches, but the inclosed cars all have a length between the axles of 96 inches. Structurally and mechanically the new models are similar to those that have been established previously by the company. But in the body details there have been a number of changes. The upholstery of the rear seats is 8 1-2 inches deep and the seats are sloped to permit of more luxury in settling against the cushioned backs. Slip pockets in the doors, sliding tool boxes in the rear seat heel board, 24-inch doors, and a system of window fastening designed to prevent rattling are some of the improvements. The fore-drive idea has been developed in some of the models.

Buffalo

The Buffalo is a new name in the list of electric vehicles, but it is in reality the successor of the veteran Babcock. The 1913 line consists of a coupé and roadster on the same chassis. The cars are equipped with Philadelphia batteries of forty-two cells and the estimated extreme speed of the roadster is 35 miles an hour, with 100 miles on a single charge. Of course, it does not mean that the car will go 100 miles at 35 miles an hour on a single charge, but that operated at the most economical rate of speed the maximum mileage will be about that distance. Optional tire equipment is offered with the preference on pneumatics. The drive is by shaft to bevel gears with a single reduction in the rear axle. The gear ratio between the bevel pinion of the shaft and the bevel on the differential is 4 to 1. Universal joints are dispensed with and three-point suspension

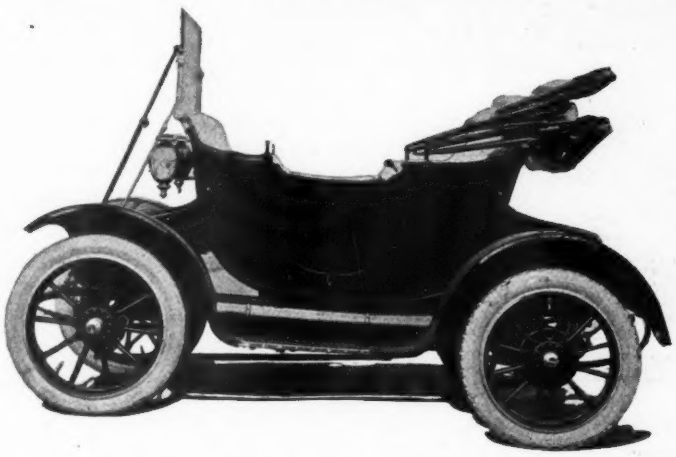
Colonial brougham with few right-angles showing in body lines, $2,700

is accomplished by two trunnion joints, one on each side of the motor with a ball-and-socket joint fastened to the middle frame cross-bar. The forward end of the drive is thus allowed to move in any direction.

Chicago

The Chicago electric makes its bow to the public by offering a coupé and limousine equipped with a forty-cell Exide battery. The cars have a seating capacity of five and their mileage is estimated at 100 on a single charge. The maximum speed is placed at 23 miles an hour. The car has five speeds and is equipped

with 36-inch cushion tires all around. The shaft-drive principle is followed without intermediate reduction between motor and propeller shaft. Options are given as to the choice of steering, either by wheel or lever. One of the distinctive features of the line is the new arched door designed to prevent the destruction of aigrettes, plumes and dress hats. The curve allows rain to drain off on both sides of the door and eliminates the danger of ruin to dresses by reason of a deluge of water from the top of the door when it is suddenly opened. It is also graceful in appearance. Special stress is laid on the body design, which is stylish and comfortable, and the interior is laid out for the all-



Columbus four-passenger car with adjustable top, front and sides

face-forward type if desired. The controller is from a special design intended to operate with continuous torque and equipped with a magnetic blowout to increase its working efficiency. Much of the usual wiring is rendered unnecessary by reason of the fact that the controller is located directly against the motor. Two universal joints are used with the propellershaft, one just behind the motor and the other immediately in front of the axle. The ratio of reduction provided by the bevels is 5 1-3 to 1. The car is designed by Frederick J. Newman.

Century

A new brougham to carry five passengers is the feature of the current line of Century vehicles. The wheelbase has been extended to 98 inches, allowing more space for body improvements. The battery is a thirty-cell Exide with an ampere-hour capacity of 150. With the improved type of Westinghouse motor the car has a mileage estimated at between 65 and 100 on a single charge. Much latitude is allowed in the selection of wheel sizes and tires to compensate for variation of service conditions in different localities. The Century drive is to bevel gear in the rear axle with universal joint behind the motor and bevel-gear reduction at 4 to 1. The car has six forward speeds. Changes from 1912 construction are really refinements and developments rather than anything radical. Lever steer is used.

Church-Field

Another comparative newcomer is the Church-Field company. The 1913 line consists of two models, a roadster and a colonial coupé. The structural feature lies in the two-speed gearset, which serves to give ten speeds forward in place of the usual five. The car is the only one before the American public thus equipped. The shifting is done mechanically through the controlling lever without adding materially to the complexity of that device. The torpedo roadster has a steering wheel. The drive is by shaft. Reduction ratios are 4 and 8 to 1.

Columbus

Five new models are presented by the Columbus company. The main changes are enlargement of the batteries all around, the stanhope having thirty-two cells of Exide battery against thirty cells last year, while the heavier types have forty cells in place of thirty-six. The drive is by shaft with first reduction by silent chain and the second by bevel gear, the total reduction ratio being 11.6 to 1. Lever steering gear is used on the inside-drive cars. The theater coupé is the feature of the line. This is a four-passenger car, heavily batteried with speed ranging from 7 to 22 miles an hour and a range of from 60 to 100 miles on a charge. The seats are arranged so that all may face forward, although one of the front seats revolves at pleasure. Safety of operation is enhanced by the new brake equipment which consists of four internal expanding brakes on the rear wheels and one contracting brake on the driving shaft. The rear tires on this model are 34 by 4 1-2 inches. Otherwise the tire sizes for all models are 34 by 4 inches.

Colonial

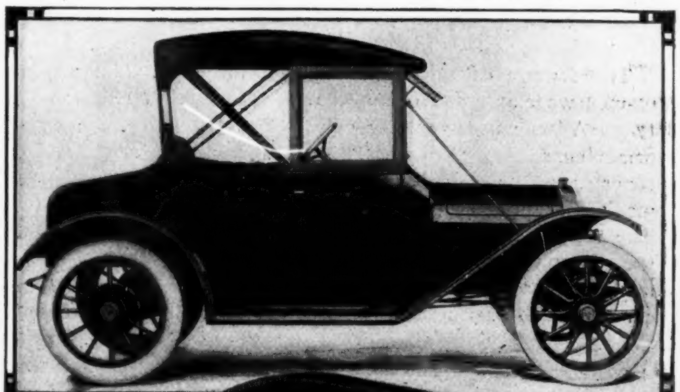
A standard four-pasenger coupé, 96-inch wheelbase and equpipped with a Willard battery of forty cells, are the features of the Colonial. A particularly graceful body design is used, the lines being unusually pleasing. The mechanical features of the car are much the same as in former practice with final drive through bevel gear. The charge mileage is estimated at 70. The car has the conventional six-speed controller.

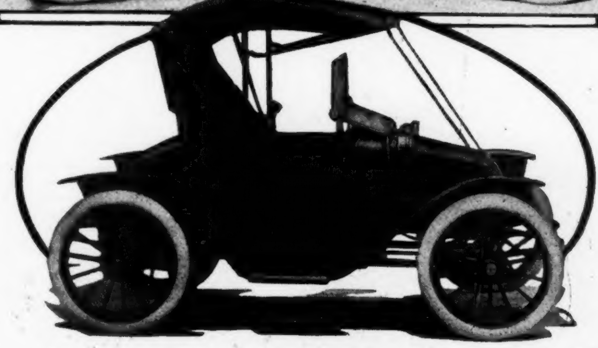
Dayton

The new model of the Dayton line is an extension coupé equipped with a thirty-cell Exide battery giving a maximum speed of 22 miles an hour. The operating mileage on a single charge is estimated at from 75 to 90. The chief improvement in the mechanical sense is the automatic cut-out in connection with the emergency brake, designed for the purpose of preventing fires or overheating of the motor when the car is not in motion. When the brake pedal is pressed down the current supply is disconnected from the motor. The car is shaft driven. It has a passenger capacity of four and the interior of the body is arranged in several styles to meet a variety of demands.

Detroit

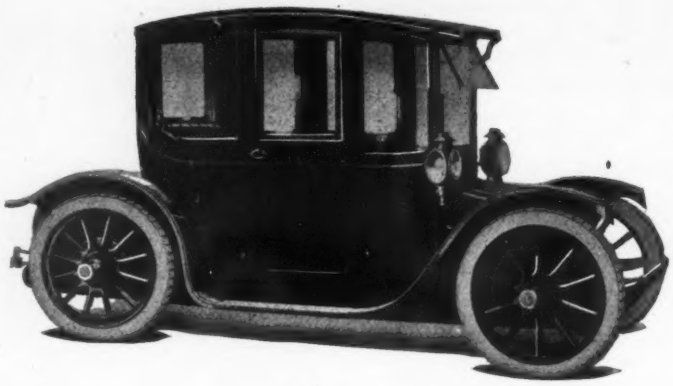
Additional battery equipment, larger wheels on some of the models, a clear-vision car and refinements of details are all the

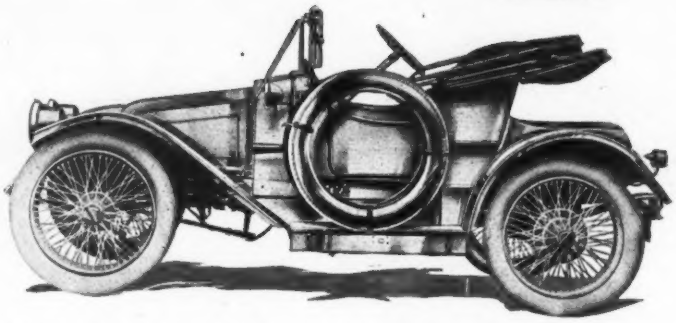




Waverley protected roadster, showing method of enclosing, $2,250
Fritchie torpedo, with battery box in rear, low and rounded, $2,400

changes made by the Anderson company, in fact, the company has announced in definite terms that for the next 2 or 3 years the changes would probably be of minor character. The batteries for 1913 are Detroit electric lead batteries of forty cells, or Edison batteries of sixty-four cells of the A-4 size. The exception is the limousine, which has a sixty-cell Edison of A-6 size. The limousine is steered with a wheel, while the stock equipment of the other models is lever steer. As compared with the 1912, the Detroit cars have two more cells of lead battery or four additional cells of Edison. The mileage figures are increased by reason of the addition. The direct shaft drive adopted by the company, using a universal joint behind the motor and geared in the rear axle at a reduction of 5 to 1, is continued throughout the line. The clear-vision car, which is being featured this year has glass panels in the rear corners of the body. This gives the driver a chance to watch traffic and avoid accidents with more facility than if some opaque substance were used. One of the new details in body construction is the substitution of aluminum for wood in the roofs of the closed cars. Several of the cars are equipped with seats all facing forward. Another change that will be noted is the abandonment of the type of hood formerly used in the roadster. In 1912 this hood gave the impression of a gasoline car, but for 1913 the graceful lines of the hood could not be mistaken for those of a gasoline automobile.





Century brougham, a typical car of 1913 in body design, $2,550
Buffalo wire-wheeled roadster equipped like gasoline car, $2,600

Electra

The feature of this new line is a torpedo roadster with a 90-inch wheelbase and equipped with a Haschke twenty-cell battery. All the usual battery options are allowed at the various prices charged for them. The car simulates a small gasoline roadster very closely in appearance. Shaft drive without intermediate reduction between motor and propeller shaft is used. The rear axle is worm driven. Control lever is located under the steering wheel, which is on the left side of the car. Pneumatic tires are favored, but the usual options are given. The company also lists a larger car with a 96-inch wheelbase.

Flanders

A single chassis fitted with victoria or colonial bodies is the Flanders line. The coupé is the featured car and this year it has a passenger capacity for five persons. The main changes are in the size of the battery, which is a thirty-cell Flanders as against a twenty-four cell-battery in 1912; the Timmerman motor, which had not been definitely adopted last year, and the rearrangement of the seats. The worm-gear drive is continued, as well as the other typical features of the mechanism. With the additional battery capacity, the car is now rated at 20 miles an hour and has a range of travel of from 75 to 100 miles on a single charge.

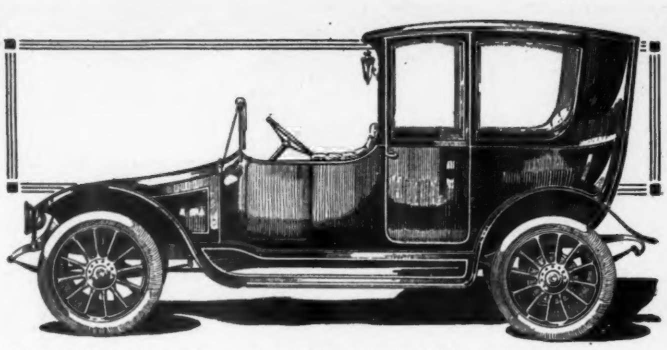
Fritchle

Besides adding a luxurious brougham, dropping its touring car and increasing the battery capacity of two models, the Fritchle vehicle is similar to its 1912 line. The new brougham has capacity for five passengers. The operator's seat is to the left and within the passenger compartment. The opposite seat faces the rear. The back seat is wide enough for three adults. The car is compactly built, the wheelbase of the brougham being only 86 inches. The motors are rated at 4 horsepower and are driven by Fritchle batteries of thirty-two cells. The Fritchle construction, embodying reach-rods between the axles, lends itself to the elliptic type of springs all around, which are used. Wooden sills are used in the frame with the idea of imparting flexibility and to avoid the chance of acid corrosion. These things are not new so far as the Fritchle is concerned, but they differ in some respects from ordinary practice. The drive is by shaft. The brakes act directly on the rear hubs.

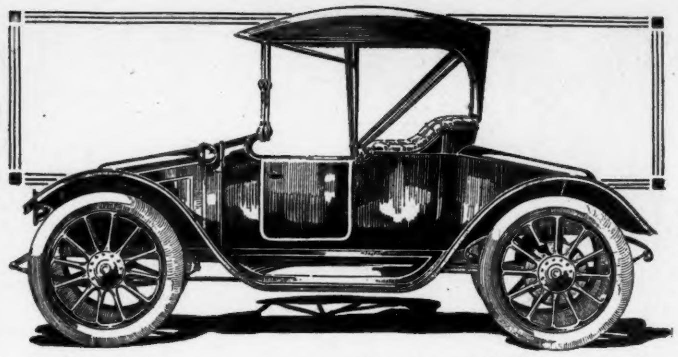
Grinnell

An all-forward drive, clear-vision brougham and a five-passenger coupé are the new things brought out by Grinnell. Structurally the cars are somewhat different from previous models. The shaft-drive principle, using two universal joints between the motor and rear axle, the reduction ratio being 4 1-4 to 1 through bevel gears has been adopted. The braking system has been changed slightly so that the new cars have

Borland-Grannis straight line brougham, $2,500; contrasted with curved-top brougham, $2,700, of same company, showing variations in bodies and external appearance



Luxurious limousine put out by Borland-Grannis—note unique design, $5,500



Roadster of same company—curved lines predominate in body and mudguards

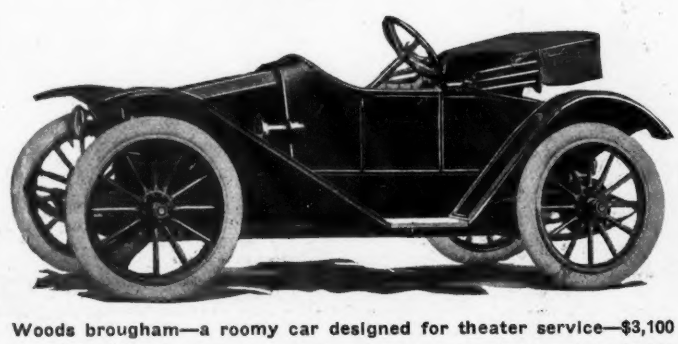
service brakes operated with the controller by hand and the emergency brakes are pedal-operated and work by internal expansion to the hubs. A thirty-cell battery, optional in type, is furnished. This is a trifle larger than formerly and the company estimates that a maximum of 125 miles can be delivered by a single charge. The normal motor speed is 900 revolutions per minute.

Ohio

Centralizing effort upon a single chassis type, this company has announced four new models, differing from one another only in the style of bodies. Battery capacity has been increased; the wheelbase of all models is lengthened to 96 inches. The 102-inch coupé has been discontinued; the chain reduction between motor and propeller shaft formerly used has been eliminated and the drive is direct shaft; Crocker-Wheeler motors delivering 800 revolutions per minute at 75 volts, 30 amperes, have been installed in place of the former equipment, and a magnetic brake operated by button-actuated switch has been installed. No universal joints are used in the drive. The armature of the motor is a hollow sleeve mounted on annular bearings. The propeller shaft passes through this sleeve and engages the forward part by a squared end. The shaft itself is short and the ratio between the beveled pinion and the bevel in the differential is 4 to 1. The motor is now attached directly to the end of the shaft. The size of the batteries has been raised from thirty or thirty-two cells to forty cells. This has led to a revision of the mileage figures as 100 miles is now estimated for a single charge. The new body styles include a colonial brougham, straight-line brougham and semi-colonial in two variations. The control of all cars is magnetic and is accomplished by the turning of a disk. Steer is by lever. An electric heater, operated by button switch, is a new feature of the regular equipment.

Phipps

A coupé, equipped with a forty-cell Exide battery, on a chassis with a wheelbase of 107 inches and fitted with wheels to take any standard type of tires 36 by 4 inches all around, is the initial offering of the Phipps company.

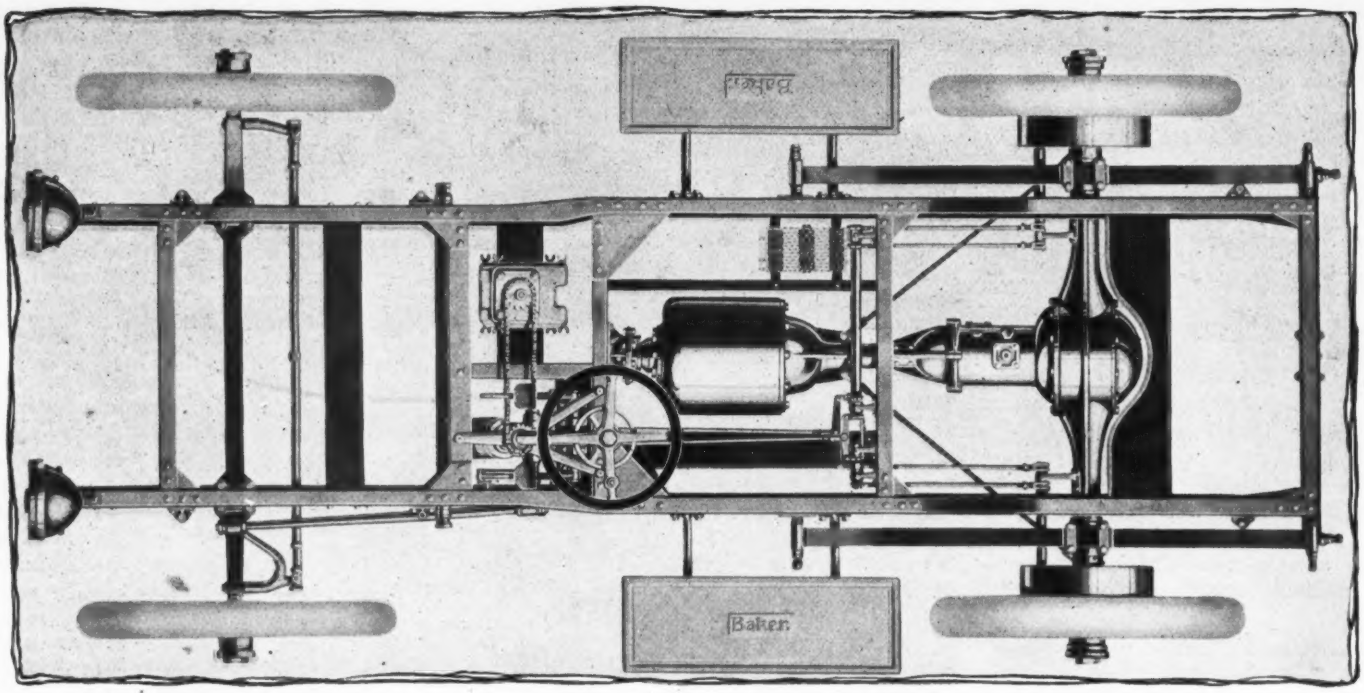


Woods brougham—a roomy car designed for theater service—$3,100
Church-Field roadster which follows lines of gasoline models, $2,300

The motor is of Westinghouse manufacture. The drive is by bevel gear. The car has a seating capacity of five adults. The control gives five forward speeds.

Rauch & Lang

The standard battery for the Rauch & Lang vehicles consists of forty cells, Exide, although sixty cells of Edison A-4 or A-6 and Ironclad are furnished at higher prices. Last year some of the smaller cars had only twenty-four cells. The changes for the coming season are rather numerous. Whereas last year seventeen models were announced, many of them being only variations in body types, this year but seven models are listed. The chief changes consist of the following: The wheelbase of six models has been lengthened 1 1-2 inches to 92 1-2 inches, and in the largest of the broughams the wheelbase is 103 inches; all bodies are lower hung, and the size of the compartment in all inclosed cars has been increased; wide option is allowed in selecting the size of wheels and tires. The size of the brake drums has been increased. The controller is now equipped with a device to prevent accidental burning of the mechanism when not in service. An automatic bell signal sounds when the foot brake is set if the current is still connected with the motor. Disconnection of the current is provided in the controller and the whole device is so arranged that the operator may know that the current is not running if the bell is silent. On the other hand, if the bell rings, it is to show that a small trigger in the controller should be set, disconnecting the batteries. The Hertner motor is used on all models and with the augmented batteries the mileage is now estimated at from 60 to 90. The maximum speed of the Rauch & Lang cars is placed at 20 miles an hour. One other feature of the bodies that will attract attention is the special type of auxiliary rain-vision shield with which the cars are equipped. This consists of a plate of glass placed at an angle to the front of the car just under the roof sill and held by appropriate adjustable frames. The shield extends sufficiently from the front window of the car to protect the glass from rain and conse-



Looking down on the Baker stripped chassis, showing structural details and mechanical principles of the car

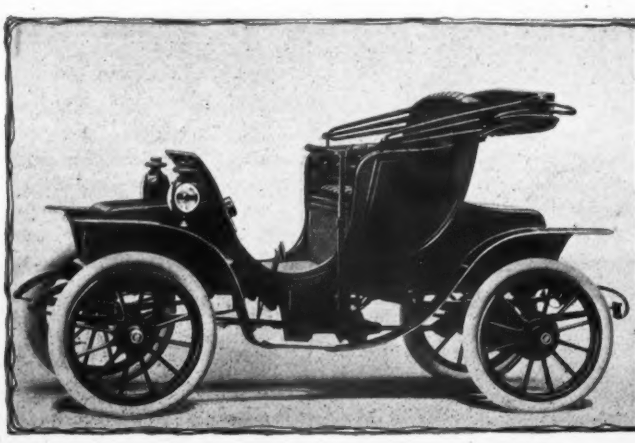
quently affords the operator a clearer view of the road than he would have without such protection. The complete line consists of four broughams, including a demi-brougham and a colonial; towncar, coach and roadster. Several variations of bodies are furnished, chief among which are a landaulet, chauffeur-driven towncar, club roadster and some others. Shaft drive with silent-chain reduction is retained throughout the line. The ratio of reduction by silent chain is 2 11-28 to 1 and that at the rear axle 3 6-13 to 1.

Standard

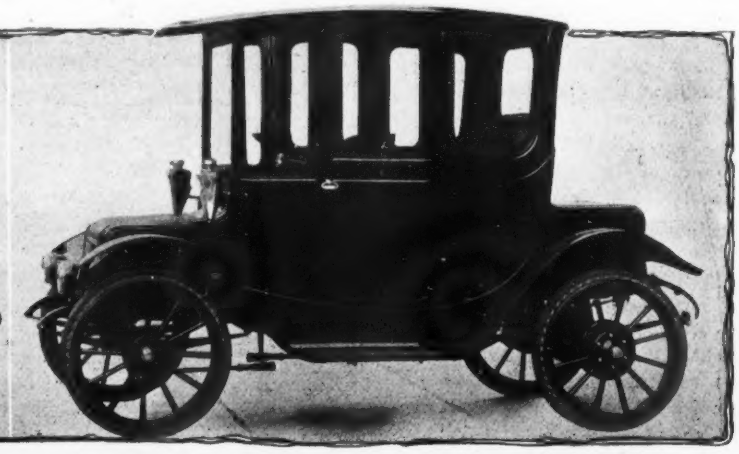
The coupé model of this company is considerably changed from last year's offering. The wheelbase is 5 inches longer and the passenger compartment has been enlarged 4 inches in width and 3 inches in height. The seating scheme has been rearranged so that the occupant of the front seat can sit at an angle of 45 degrees, facing the opposite rear corner, instead of sitting with his or her back to the front of the car. A divided, clear-vision windshield and a ventilator over the front window have been added. The springs have been lengthened 10 inches. The wheelbase is 96 inches. The drive is by shaft without universal joints. Double reduction gears are built into the rear axle. The battery equipment is a thirty-cell Exide, with options at higher prices.

Waverley

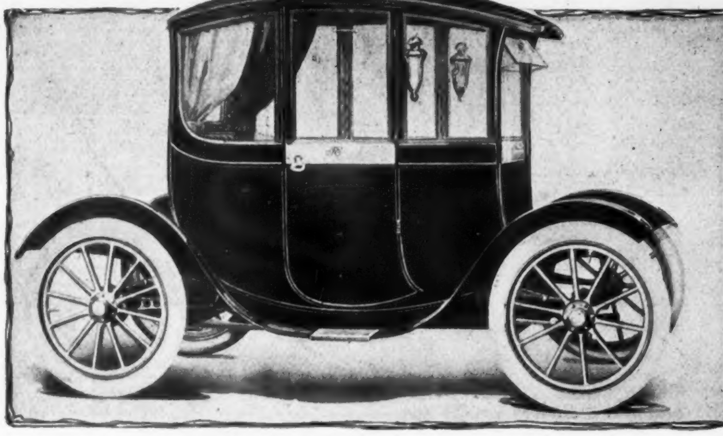
Four new models, one materially changed style and the continuation of one model with minor changes are announced by the Waverley company. The new cars are a limousine, Georgian brougham, Empire brougham and colonial brougham. The model that has been sharply changed is the limousine that was featured last year and the one in which minor changes have been made is the sheltered roadster. Generally it may be said that the most noticeable change in all the models is the greater-capacity batteries furnished. Last year the standard cars had thirty-two cells Exide with thirty-four cells in the limousine. This year the standard is forty cells Exide with thirty-four cells in the roadster and optional equipment of Edison or other types of batteries at appropriate increases in price. Eighty-volt motors have been installed in all the heavier cars. The transverse shaft drive, first reduction being in the ratio of 1.76 to 1 and the bevel ratio being 4 to 1, unique in this make, is retained, as are all the essential features of 1912. The new limousine has a divided rear seat, making three spaces, with the middle space or seat slightly in rear of the other two. The car is driven from the left rear seat, while a cozy-corner seat in the right front corner does not interfere with the operator's view ahead. This car has a wheelbase of 106 inches and an estimated range of 75 miles on a charge. The Georgian brougham is 3 inches longer,

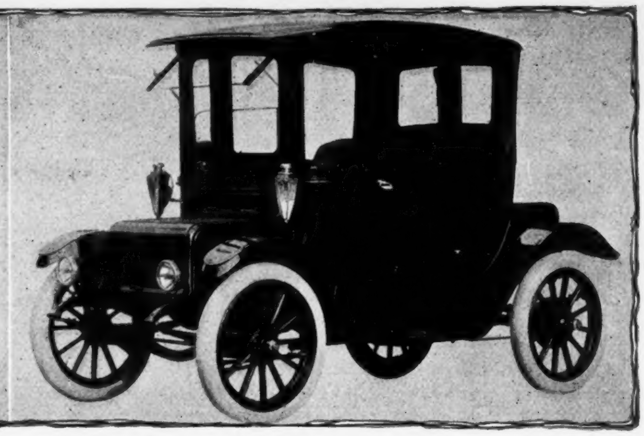


Broc stanhope model 20, price $2,100; also in victoria



Broc fore-drive brougham, model 31, price $3,500

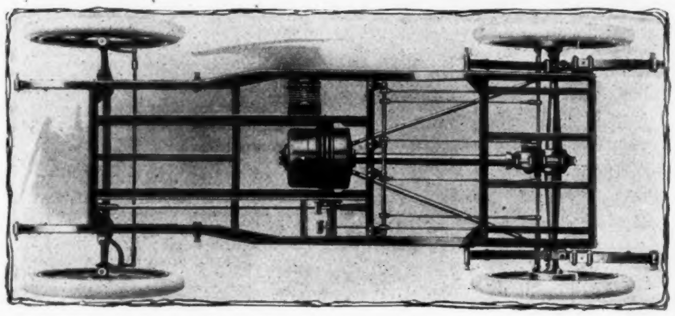

Flanders colonial coupé, listed at $2,500


Broc curved top brougham, model 29, price $3,100

but otherwise structurally the same as the limousine. The passenger compartment is arranged so that the person who sits in front of the driver sits with his or her back to the side of the car. The rear battery box is separate from the body. The Empire brougham has the same seating arrangements as the foregoing, but the wheelbase is 106 inches and the battery box behind is connected with the body. The colonial brougham is 2 inches shorter than the Empire and is equipped with the typical characteristics of the colonial style of coach building. The five-passenger limousine continued from 1912 has 5 inches more wheelbase, 5 inches wider rear seat, lower sill, larger battery, bigger motor and semi-irreversible steering mechanism. Several of the former models that proved popular are continued without radical change. Lever steer, wooden trussed frames, I-beam front axles and the other established features of the Waverley product are continued.

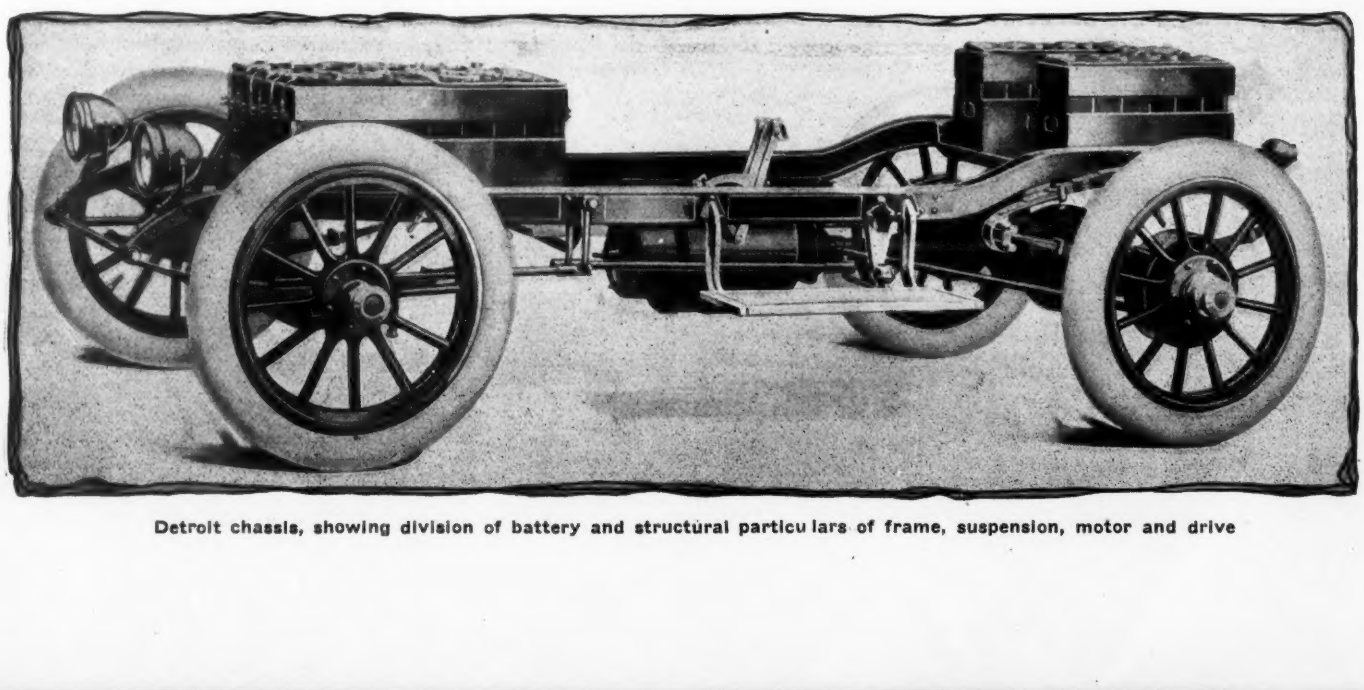
Woods

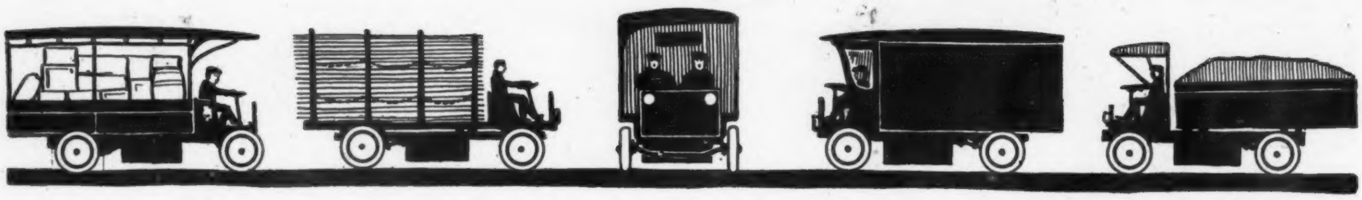
Elimination of weight, drop frames, giving lower suspension of bodies, more graceful lines, heavier and larger batteries with a meter on the charging plug, two-point motor suspension, reinforced rear axle having radius rods to the torsion tube, and a system of fastening the batteries in place are the improvements announced for the Woods line. The shaft drive with herringbone gear reduction and other structural and mechanical features are retained. The standard Woods battery is forty-cell Exide, but in the 102-inch brougham a Woods battery of forty-two cells is installed. Dual-tread solid tires of a different type than any used before on an electric passenger car are stock equipment for several of the models, although other options are offered. The motor and mechanical changes are designed to give easy riding qualities and greater mileage through the elimination of vibration. The two-point suspension and the bracing of the torsion tube by radius rods are all part of the plan to further adapt shaft drive to solid or cushion-tire equipment, which has been worked out with so much success by this company.


Looking down upon chassis of Standard, showing mechanical details

Hupp-Yeats

The Regent model is the special element of this line emphasized this year. This is a coupé similar in every way to the foregoing model of the same type. It has a twenty-seven cell Exide battery, ranged in three trays. The motor is located upon the rear axle, driving by bevel-spur gear at a reduction of 4 to 1. The car is very low slung but the frame has a rise of 9 inches at the rear. The interior of the car is roomy and lends itself to a rather wide latitude in the matter of seating arrangements, despite the fact that the wheelbase is only 86 inches. The motor is of Westinghouse design. The rear axle is of the semi-floating type. Lever steer is regular equipment. The car seats four.

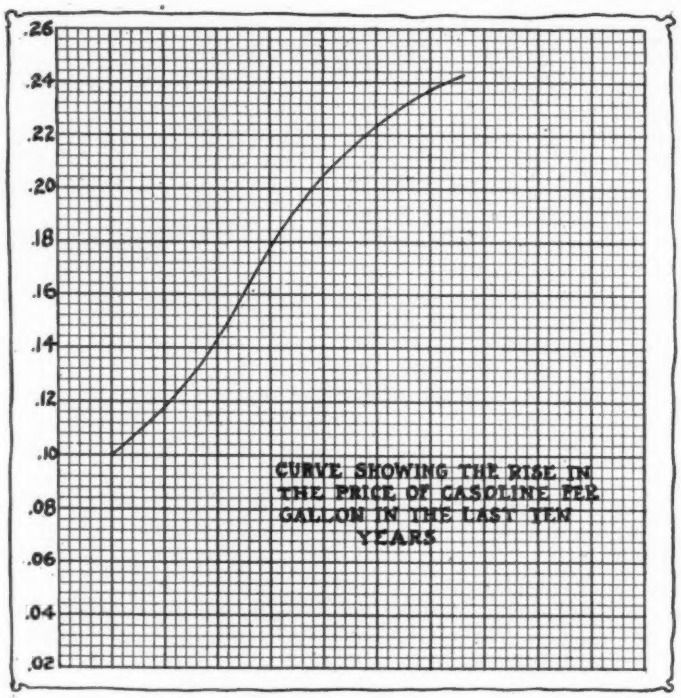

Detroit chassis, showing division of battery and structural particulars of frame, suspension, motor and drive



The Electric Commercial Vehicle

Two-Thirds of Those in Use at Present Are of 2 to 3-Ton Type
Field Is Rapidly Enlarging and Future of Industry Is Bright

STATISTICIANS estimate that about two-thirds of the electric trucks in use at the present time are of the 2 to 3-ton size. The past year has seen many new concerns which have never owned or operated electric vehicles buying one or two trucks, endeavoring to find out which is the best suited for their business, before installing a large fleet. The forecast for this season's models does not show any radical departure from present practice. Minor improvements or changes will be made from lessons learned. One of the pronounced trends is to increase the types of vehicles manufactured by building one or more heavier models. Included in this class are such concerns as the Baker that has added a new model, Type C C, with a carrying capacity of 7,000 pounds; Detroit, Model 7, 7,000 pounds; Ward, with an entire new line, including a 2 and 4-ton chassis in addition to smaller ones; Waverley, with three new chassis of 4,000, 7,000 and 10,000 pounds capacity; and the Victor, which purposes giving up smaller vehicles and confining itself to the 3.5 and 5-ton chassis. The Atlantic Vehicle Company, which offered its product to the public about the middle of last year, also caters to the heavy class with 3.5 and 5-ton trucks, and, being a newcomer, the line that it offers is somewhat indicative of the general demand.



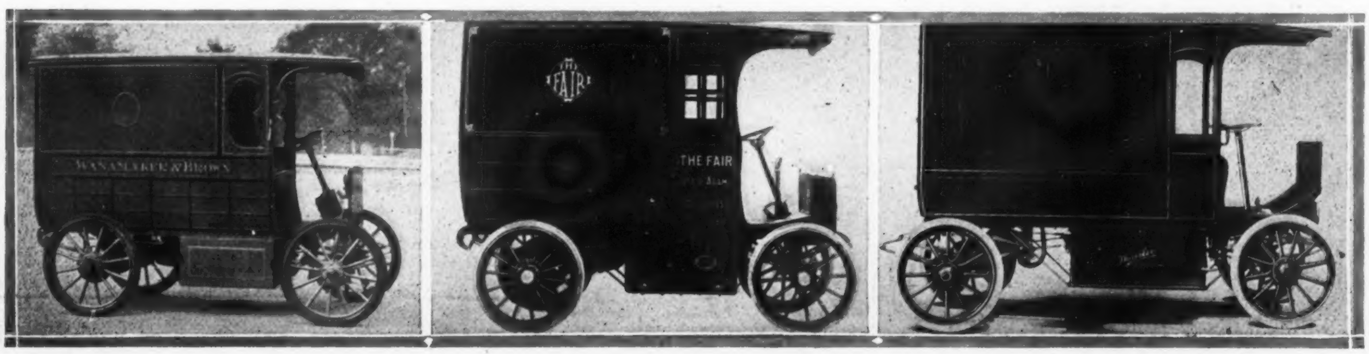
Silent chain of the inverted tooth type is very popular as a method of transmitting the power from the motor to the differential, where final chain drive is used, offering as it does a certain degree of flexibility of drive coupled with silence, while its efficiency is materially enhanced by protecting it from foreign matter by inclosing it in an oil-tight and dust-proof casing. Among the concerns that use this method of drive are Detroit, Baker, General Vehicle, Urban, Ward and Atlantic.

As a contrast to this type there is the Lansden company, which couples the motor direct to the differential, an extension of the differential casing being bolted direct to the motor housing, with chains as a final drive.

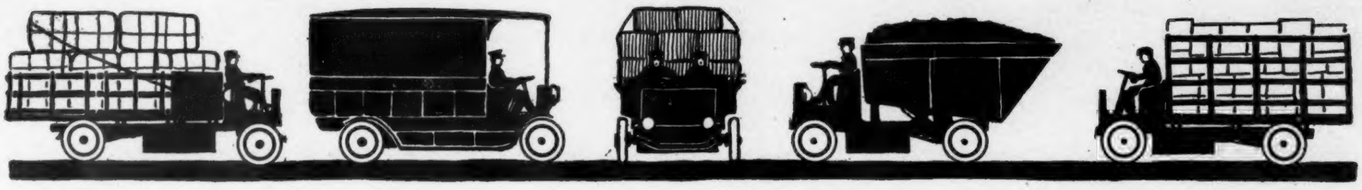
Other concerns such as the G. M. C. and the Waverley, in their new models, interpose a shaft between the motor and the countershaft, thereby locating the motor over the rear axle and driving forward. M. & P. reverse this method by placing the motor forward under the seat and transmitting to the differential through a universal-jointed shaft.

Left-hand steering, adopted several years ago, remains as standard. Some concerns have given a slight rake to the steering column, but there is no marked departure from last year's practice.

The wooden or metal-lined battery cradle is giving way to the



Left—Commercial Truck Company's 500-pound wagon. Center—Kentucky 1,000-pound wagon. Right—Waverley 1,000 pounds vehicle

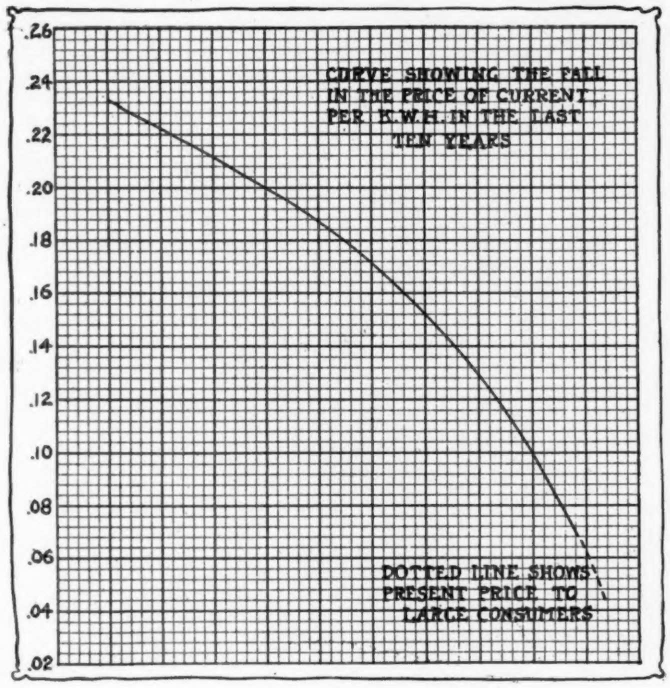


Tendencies and Constructional Details

Many Companies Are Adding Heavier Machines to Their 1913 Lines Considerable Progress Made in Battery Equipment Standardization

all-steel construction. Some manufacturers, such as the Lansden and Detroit, hinge the sides at the bottom so that when they are swung open they form, with the aid of supports, a tray upon which the battery can be withdrawn to afford inspection, leaving the top hermetically sealed, thus excluding all foreign matter. To facilitate the withdrawal in some cases the battery is made to slide on rollers in grooves.

Battery equipment has become considerably more standardized during the last year, and the new models show a tendency towards 42 or 44 cells lead type, or 60 cells Edison. The number of plates per cell depends upon the vehicle capacity. With perhaps the exception of the G. M. C. and the Champion, practice is to suspend the battery below the frame forward of the center.



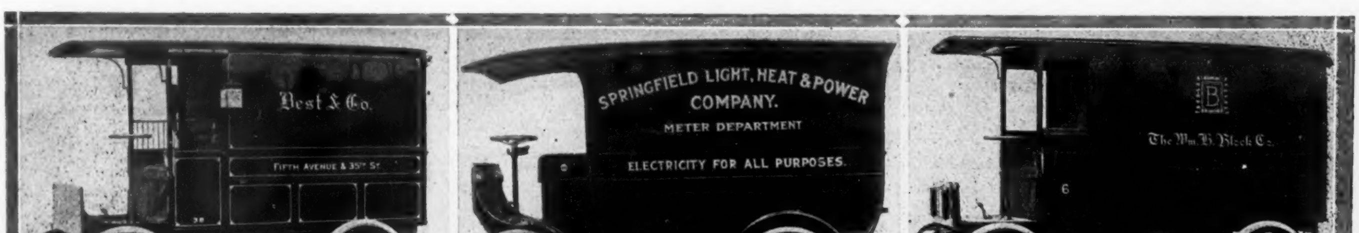
One of the greatest points in favor of the electric is that it is self-governing as to speed. The maximum speed cannot be exceeded unless the driver deliberately permits the power to add to momentum when going down hill. As there are no gears to mesh, the power should be cut off and the vehicle allowed to coast at a moderate speed, thereby saving current. If this is done the mileage radius of the battery will be so much more increased if only the driver would ease off the power when he sees that he must make a stop several feet ahead. Some drivers have a bad habit of keeping their feet constantly upon the brake pedal, bringing the shoes in constant contact with the brake drums and thus throwing additional work upon the motor and unnecessarily consuming current.

The following is a table compiled by averaging the speeds as given by several of the principal makers in their instructions, with a table compiled by Alexander Churchward.

Load Capacity in Pounds	Maximum Speed in Miles Per Hour	Mr. Churchward's Table, Miles Per Hour
500	16-20	.. ..
1,000	13	12 to 13
2,000	11	10 to 11
3,000	10	10
4,000	9	8 to 9
7,000	8	7 to 8
8,000	7	6.5 to 7.5
10,000	5.5	6 to 7

Each maker has his own idea of the speed at which his vehicle should travel, and while it might be perfectly safe for one truck to be driven at 10 miles per hour without any harm, another with different suspension would suffer materially from the results of excessive vibration.

It stands to reason that the same speed cannot be attained with a full load as when the vehicle is running empty, consequently it behooves the person in charge to see that the driver does not take advantage of this fact and make fast time in returning from deliveries. More harm is accomplished in driv-



Left—General Vehicle of 1,000-pound type. Center—1,000-pound Argo with distinctive body. Right—2,000-pound General Vehicle

ing an electric truck fast without a load than when it is driven to the maximum with a load. The load relieves the frame of part of the vibrations, and although solid rubber tires are capable of absorbing part of the road shocks, nevertheless a major portion is transmitted throughout the entire vehicle.

There has been a healthy impetus given to the electric vehicle business in general through the whole-hearted co-operation of the various central stations and electric power companies throughout the country. These companies not only set the good example by using electric vehicles themselves, but also offer attractive rates to current consumers, and in some cases are catering to the charging of electric trucks in special garages erected for the purpose.

The rate for charging current has dropped in the last few years and some stations have notified their intention of still further reducing the cost to both small and large consumers. Reference to the curves on pages 24 and 25, will make it apparent that the cost of electrical current has dropped in almost direct proportion to the rise in the price of gasoline. The cost of current worked against the electric in the early days, but now this objection has been removed.

The present efficiency of the electric is in no small measure due to the general advances that have been made in automobile construction, tending to simplicity and comparative lightness of design, thus rendering this type of vehicle more efficient in the few working parts that it possesses.

The standard tire and wheel dimensions for solid tires as recommended by the Society of Automobile Engineers have been generally adopted by the makers, and this has brought about a much better state of affairs, cutting down the idle time caused by tire replacements.

The average wheelbase of all models of electric trucks has

Tabulated Review of 1913 Electric Trucks, Giving Mechanical and Electrical Details

Name and Model	Price, Chassis Only	Body Style	Price With Body	Body Style	Price	Body Style	Price	Load, Capacity in Lbs.	Width of Load Space in Feet	Height of Load Space in Feet	Length of Load Platform in Feet	Overall Length in Feet	Wheelbase, Inches	Tires Front	Tires Rear	Body Weight in Lbs.	Chassis Weight in Lbs.	Turning Radius in Feet
Argo, K-10	$1700	Opt'l		Express	$1800			1000	3.5		6.6		86	34x3	34x3	400	2400	
Argo, K-20	2100	Opt'l		Express	2200			2000	3.5		7.5		96	35x3½	35x3½	400	3000	
Atlantic, 1 ton	2400*	Opt'l						2000	5.0		8.0		102	34x3½	34x4		4400	
Atlantic, 2 ton	3000*	Opt'l						4000	5.0		10.5		114	34x4	36x3		5700	
Atlantic, 3½ ton	3500*	Opt'l						7000	6.0		12.0		135	36x5	40x4		7700	
Atlantic, 5 ton	4000*	Opt'l						10000	6.0		12.0		144	36x6	40x5		9200	
Bailey, Service		Deliv'y						300	3.6	3.3	4.0		106	33x4	33x4			
Baker, W	1700*	Open		Panel				500	Opt								2085	
Baker, X	1900*	Opt'l						1000	Opt								2650	
Baker, O	2300*	Opt'l						2000	Opt								3125	
Baker, U	3100*	Opt'l						4000	Opt								5200	
Baker, CC	3500*	Opt'l						7000	Opt								7500	
Borland, Open Type		Op. Tr'k.	$2100	Closed	2250			1500	4.8	6.0			93	34x4	34x4			
C.T., 500-pound	1800	Panel	2000					500	3.5		5.5		85	36x2½	36x2½	350	2600	19
C.T., 1,000-lb	2000	Panel	2200					1000	3.5		6.0		90or100	36x3½	36x3	400	3100	20
C.T., 1 ton		Panel	2800					2000	4.0		8.0		100	36x3½	36x4	600	3900	21
C.T., 2 ton	3200	Express	3500	Stake	3500			4000	4.2		11.0		116	36x5	36x3½	1000	5250	24
C.T., 3½ ton	4200	Express	4500	Stake	4500			7000	5.0		12.0		115	36x3½	36x3½	1250	7000	24
C.T., 5 ton	4650	Express	5000	Stake	5000			10000	5.5		15.0		132	36x4	36x4	1500	8000	26
Detroit, 1	2345	Express	2520	Can.Top.	2590	Panel	$2730	1000	3.8	4.6	6.5	11.0	80	32x2½	34x3		2400	
Detroit, 2	2870	Express	3080	Can.Top.	3150	Panel	3310	2000	3.9	4.6	6.9	11.5	84	32x3	34x3½		2900	
Detroit, 3	3132	Opt'l						3000	4.3	Opt	Opt		96	34x3½	36x4		3700	
Detroit, 7	5000	Opt'l						7000	Opt	Opt	Opt	19.0	132	36x5	36x4		8115	
Fritchle, Com	2000	Deliv'y						1000					100	32x3½	32x3½			
G.V., 750-pound	1080	Deliv'y						750	3.3	4.4	4.9	9.9	76	32x2½	32x2½		2460	
G.V., 1,000-lb	1370	Deliv'y						1000	3.4	5.0	6.0	10.9	87	36x2½	36x2½		3090	
G.V., 1 ton	1710	Deliv'y						2000	4.0	5.5	8.0	12.5	102	36x3½	36x3½		3985	
G.V., 3½ ton	2620	Express						7000	5.0	6.0	13.0	16.5	128	36x6	36x3½		7500	
G.V., 5 ton	2950	Express						10000	6.0	6.0	15.0	18.5	139	36x7	36x5		8450	
Jatco, C	1800	Express	2000	Panel	2100			2000	3.9		7.3	10.9	84	32x3	32x3	250	2600	
Jatco, D	1400	Express	1500	Panel	1600			1000	3.9		7.3	10.9	84	34x3½	34x3½	300	3000	
Lansden, 1,000-lb	2300	Platf'm	2450	Express	2500	Panel	2675	1000	3.9	5.5	7.6	11.8	96	36x2½	36x2½	550	2200	16
Lansden, 1 ton	2775	Platf'm	2925	Express	3050	Panel	3175	2000	3.9	5.6	9.5	13.9	106	36x3	36x3	600	3400	17
Lansden, 2 ton	3570	Platf'm	3820	Express	3920	Panel	3995	4000	4.1	5.8	11.0	15.3	120	36x4	36x3	800	5200	18
Lansden, 3½ ton	4390	Platf'm	4690	Express	4790	Panel	4890	7000	4.5	6.0	12.0	16.5	130	36x5	36x3½	1200	6800	20
Lansden, 5 ton	5090	Platf'm	5390	Express	5490	Panel	5640	10000	4.8	6.0	13.5	17.3	142	36x6	36x6	1500	8500	23½
M. & P., 1500-lb	1450	Express	1500	Closed	1600			1500	3.5		6.7	11.3	100	30x3	30x3	700	2700	
M. & P., 2500-lb	1850	Open	1900	Closed	2000			2500	3.8		7.7	12.5	112	34x3	34x3	900	3200	
Urban, 10	1250	Express	1800	Panel	1900			1000	3.5	4.8	6.0		86	36x3	36x3	500	1900d	38
Urban, 20	1600	Express	2300	Panel	2400			2000	4.2		8.0		100	36x3½	36x4	750	3300d	44
Urban, 40	2200	Platf'm	3000	Express	3100	Panel	3200	4000	5.7		10.9		118	36x4	36x3	1000	4200d	50
Urban, 70	2800	Platf'm	3800	Express	3900	Panel	4000	7000	6.3		12.0		130	36x5	36x4	1200	5600d	54
Walker, G. & F		Opt'l						1000										
Walker, C		Opt'l						1500										
Walker, B		Opt'l						3500										
Walker, D		Opt'l						5000										
Walker, E		Opt'l						7000										
Ward, E. B		Express		Panel		Screen		2000	3.8	5.0	8.0	11.5	96	34x4	34x4	800	4800	20
Ward, E. D		Express		Panel		Screen		8000	4.5	6.5	12.0	15.5	132	36x6	36x4	2300	8000	28
Ward, E. C		Express		Panel		Screen		4000	4.0	5.5	9.5	13.0	114	36x5	36x3	1200	5500	24
Ward, E. A		Express		Panel		Screen		1000	3.5	4.5	6.5	10.0	84	34x3	34x3	500	2500	17
Waverley, 1,000-lb		Panel						1000	3.6	4.6	6.0		91	34x2½	34x2½	450	2975	32
Waverley, 2000-lb		Opt'l						2000					108	34x3½	34x3½	1000	3400	36
Waverley, 2 ton		Opt'l						4000				16.0	114	36x4	36x3	1500	6300	44
Waverley, 3½ ton		Opt'l						7000				6.5	127	36x6	36x3½	1750	7250	50
Waverley, 5 ton		Opt'l						10000				18.0	136	36x7	36x5	2000	9700	52

Note.—*Price with lead battery; Opt., Optional loading space.

increased several inches, with the exception of the 2-ton chassis, which remains about the same. The following table gives the average wheelbases for the various sizes of trucks for 1912 and 1913:

Carrying Capacity, Pounds	Average 1912 Wheelbase, Inches	Average 1913 Wheelbase, Inches
1,000	85	90
2,000	93	100
4,000	118	117
7,000	125	130
10,000	132	140

In the compilation of this table the standard wheelbases have been taken as the basis of the calculations, but in special designs built to order the standard is not always adhered to.

There is at present some lack of standard as to the type of lamp, and at the recent meeting of the Electric Vehicle Association it was proposed to adopt the Edison bayonet-type of fitting in preference to the screw type. A consensus of opinion among those present at the meeting was in favor of the bayonet type.

The following table has been compiled from statistics obtained by THE AUTOMOBILE, and shows the number of manufacturers engaged in the manufacture of vehicles of various capacities:

Capacity, Pounds	Number of Manufacturers	Capacity, Pounds	Number of Manufacturers
500 pounds	4	5,000 pounds	1
1,000 pounds	13	6,000 pounds	1
2,000 pounds	13	7,000 pounds	8
3,000 pounds	2	8,000 pounds	1
4,000 pounds	8	10,000 pounds	6

The following is a brief resumé of the general features of the different electric commercial vehicles offered by the various makers for the coming year. Such points as battery equipment and suspension, control, motor location and method of drive have been handled. In addition to these items more specific information concerning weights, prices and other useful information is contained in the detailed tabulation given herewith.

of All Vehicles, as Well as Body Styles, Prices and Chief Points of Equipment

BATTERY			MOTOR			Right or Left Steer	Location of Control Lever	Number For'd Speeds	Drive	Total W'ght Chassis and Body	SPRINGS		Front Axle	W'ght Over Front Wheels	W'ght Over Rear Wheels
Make and No. of Cells	Ampere Hour Cap.	Miles per Charge	Make	Type	Location						Front	Rear			
Opt., 28, 40, 60	135 or 162	40–50	Westinghouse	Series	Unit with r'r axle	Left	Under wheel	4	Bevel	2800	½ Ell	½ Ell	Tubular		
Opt., 30, 40, 60	162 or 185	40–50	Westinghouse	Series	Unit with r'r axle	Left	Under wheel	4	Bevel	3400	½ Ell	½ Ell	Tubular	2000	3000
Opt., 44, 60		55–60	Gen. Electric	Series	Over rear axle	Left	Left of seat	4	Chain		½ Ell	½ Ell	I-Beam		
Opt., 44, 60		50	Gen. Electric		Over rear axle	Left	Left of seat	4	Chain		½ Ell	½ Ell	I-Beam		
Opt., 44, 60			Gen. Electric		Over rear axle	Left	Left of seat	4	Chain		½ Ell	½ Ell	I-Beam		
Opt., 44, 60			Gen. Electric		Over rear axle	Left	Left of seat	4	Chain		½ Ell	½ Ell	I-Beam		
Edison, 60	150	60–80	Gen. Electric	Series		Left	Top of wheel	6	Chain	2200	½ Ell	Ell	I-Beam		
Lead, 30		75	Gen. Electric	Series	Under chassis	Left	Under wheel	6	Chain		½ Ell	Ell	Tubular		
Opt., 42, 60		50	Gen. Electric	Series	Under chassis	Left	Under wheel	5	Chain		½ Ell	½ Ell	I-Beam		
Opt., 42, 60		50	Gen. Electric	Series	Under chassis	Left	Under wheel	5	Chain		½ Ell	½ Ell	I-Beam		
Opt., 42, 64		50	Gen. Electric	Series	Under chassis	Left	Under wheel	5	Chain		½ Ell	½ Ell	I-Beam		
Opt., 42, 60		50	Gen. Electric	Series	Under chassis	Left	Under wheel	5	Chain		½ Ell	½ Ell	I-Beam		
Exide, 40	116	50	Gen. Electric	Series	Amidships	Left		6	Chain		½ Ell	½ Ell	I-Beam	750	750
Opt., 42, 60			Gen. Electric	Series	Under chassis	Left	Under wheel	3	Worm		¾ Ell	½ Ell	Box	1840	2760
Opt., 42, 60			Gen. Electric	Series	Under chassis	Left	Under wheel	3	Worm		¾ Ell	½ Ell	Box	1840	2760
Opt., 42, 60			Gen. Electric	Series	On axle	Left	Under wheel	4	Spur	4500	½ Ell	½ Ell	Box	2600	3900
Opt., 42, 60			Gen. Electric	Series	On axle	Left	Under wheel	4	Spur	6800	½ Ell	½ Ell	Box	4200	6300
Opt., 42, 60			Gen. Electric	Series	On axle	Left	Under wheel	4	Spur		½ Ell	½ Ell		10000	10000
Opt., 42, 60			Gen. Electric	Series	On axle	Left	Under wheel	4	Spur	10000	½ Ell	½ Ell		10000	10000
Edison, 60	150	55	Own	Series	Rear of battery	Left	On wheel	5	Chain		½ Ell	½ Ell	I-Beam	1350	2650
Edison, 60	225	55	Own	Series	Rear of battery	Left	On wheel	5	Chain		½ Ell	½ Ell	I-Beam	1140	2385
Edison, 60	225	50	Own	Series	Rear of battery	Left	On wheel	5	Chain		½ Ell	½ Ell	I-Beam	3080	4620
Edison, 60	375	40	Own	Series	Rear of battery	Left	On wheel	5	Chain		½ Ell	½ Ell	I-Beam	6956	10434
Own, 32			Own	Comp	Under chassis	Left	Left of seat	5	Chain		Ell	Ell	Solid		
Opt., 44	104		Gen. Electric	Series	Amidships	Center	Left	4	Chain		½ Ell	½ Ell			
Own, 44	138		Gen. Electric	Series	Amidships	Center	Left	4	Chain		½ Ell	½ Ell			
Own, 44	162		Gen. Electric	Series	Amidships	Center	Left	4	Chain		½ Ell	½ Ell			
Own, 44	270		Gen. Electric	Series	Amidships	Center	Left	4	Chain		½ Ell	½ Ell			
Own, 44	324		Gen. Electric	Series	Amidships	Center	Left	4	Chain		½ Ell	½ Ell			
Opt., 30	165	50	Westinghouse	Series	Under chassis	Left	Top of wheel	4	Chain	2850	½ Ell	½ Ell	I-Beam		
Opt., 40	165	40	Westinghouse	Series	Under chassis	Left	Right of seat	4	Chain	3300	½ Ell	½ Ell	I-Beam		
Edison, 60	150	60	Gen. Electric	Series	Under frame	Left	Under wheel	4	Chain	2750	½ Ell	½ Ell	I-Beam	1500	2250
Edison, 60	225	60	Gen. Electric	Series	Under frame	Left	Under wheel	4	Chain	4000	½ Ell	½ Ell	I-Beam	2700	3500
Edison, 60	300	50	Gen. Electric	Series	Under frame	Left	Under wheel	4	Chain	6000	½ Ell	½ Ell	I-Beam	4500	5500
Edison, 60	375	50	Gen. Electric	Series	Under frame	Left	Under wheel	4	Chain	8000	½ Ell	½ Ell	I-Beam	6750	8250
Edison, 60	450	50	Gen. Electric	Series	Under frame	Left	Under wheel	4	Chain	10000	½ Ell	½ Ell	I-Beam	9000	11000
Gould, 40	130	40	Westinghouse		Under seat	Left	Left	4	Chain	3400	Ell	Ell	I-Beam		
Gould, 40	170	50	Westinghouse		Under seat	Left	Left	4	Chain	4100	Ell	Ell	I-Beam		
Exide, 30	165	40	Gen. Electric	Series	Under chassis	Left	Under wheel	4	Chain	2400	½ Ell	½ Ell	I-Beam	1850	2550
Exide, 44	165	40	Gen. Electric	Series	Under chassis	Left	Under wheel	4	Chain	4050	½ Ell	½ Ell	I-Beam	2800	4848
Exide, 44	220	35	Gen. Electric	Series	Under chassis	Left	Under wheel	4	Chain	5200	½ Ell	½ Ell	I-Beam	3800	7975
Exide, 44	275	35	Gen. Electric	Series	Under chassis	Left	Under wheel	4	Chain	6800	½ Ell	½ Ell	I-Beam	5500	11500
Opt., 40, 60				Series	Unit with r'r axle	Left	Left of seat	4	Int G		½ Ell	¾ Plat	I-Beam		
Opt., 42, 60				Series	Unit with r'r axle	Left	Left of seat	4	Int G		½ Ell	¾ Plat	I-Beam		
Opt., 42, 60				Series	Unit with r'r axle	Left	Left of seat	4	Int G		½ Ell	¾ Plat	I-Beam		
Opt., 44, 60				Series	Unit with r'r axle	Left	Left	6	Int G		½ Ell	¾ Plat	I-Beam		
Opt., 44, 60				Series	Unit with r'r axle	Left	Left	6	Int G		½ Ell	¾ Plat	I-Beam		
Opt., 42, 60	140	40–50	Gen. Electric	Series	Rear	Left	Left	4	Chain	5600	½ Ell	½ Ell	Solid	2900	4800
Opt., 42, 60	252	30–35	Gen. Electric	Series	Rear	Left	Left	4	Chain	10300	½ Ell	½ Ell	Soild	5900	12600
Optional, 42, 60	196	35–45	Gen. Electric	Series	Rear	Left	Left	4	Chain	6700	½ Ell	½ Ell	Solid	3700	8000
Opt., 42, 60	112	45–60	Gen. Electric	Series	Rear	Left	Left	4	Chain	3000	½ Ell	½ Ell	Solid	1500	2500
Opt., 42	135	50	Own	Series	Under chassis	Left	Left	4	Bevel	3425	Ell	Ell	I-Beam	1740	2685
Opt., 42	189	50	Own	Series	Under chassis	Left	Left	4	Bevel	4400	½ Ell	½ Ell	I-Beam	2400	4000
Opt., 42	216	45	Optional	Series	Under chassis	Left	Left	4	Chain	7800	½ Ell	½ Ell	I-Beam	3900	7900
Opt., 42	270	40	Optional	Series	Under chassis	Left	Left	5	Chain	9000	½ Ell	½ Ell	I-Beam	6000	10000
Opt., 42	324	35	Optional	Series	Under chassis	Left	Left	5	Chain	11700	½ Ell	½ Ell	I-Beam	8070	13610

ABBREVIATIONS.—Opt, either lead or Edison battery; Comp, compound-wound generator; ½ Ell, semi-elliptic springs; Ell, elliptic springs; ¾ Ell, three-quarter elliptic springs; Bevel, shaft drive with bevel gear reduction; Worm, shaft drive with worm gear reduction; Spur, direct drive from armature shaft through spur gear in wheel.

The following brief reviews of the various makes of electric commercial cars will serve to indicate the progress made by each during the past year as well as to give an idea of each company's line for the season of 1913:

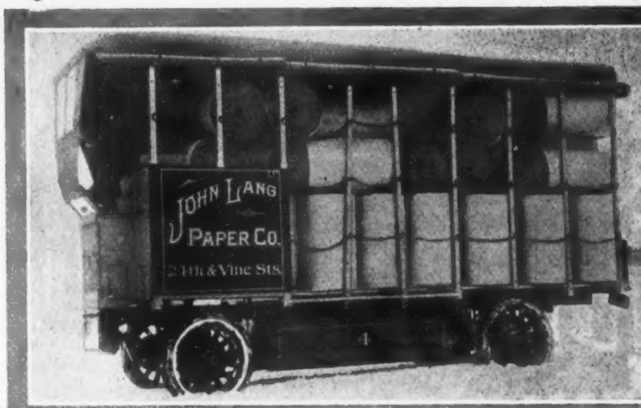
Argo

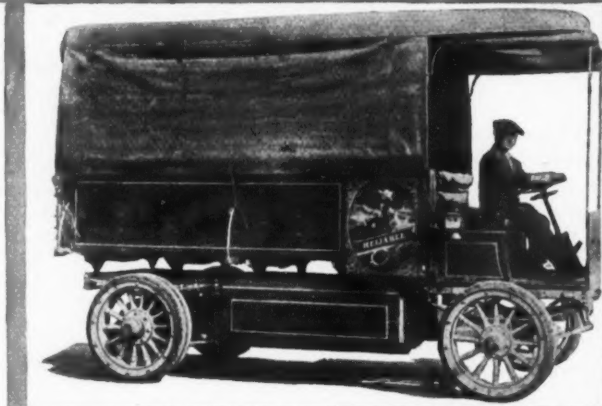
¶ These vehicles are made in two models, namely, 1,000 and 2,000 pounds. The battery equipment for both is forty cells M. V. Exide with eleven plates each for one and thirteen plates for the other. Four speeds are provided in both cases, giving a graduation of 2, 4, 8 and 12 miles per hour. The battery box is suspended from the main frame by a subframe with side doors. A separate door in the truck platform is provided above the battery to facilitate flushing. No material change has been contemplated for the ensuing year either as to battery location or on any mechanical points. Final drive is by bevel gear, the motor being coupled to the rear axle, forming a single unit. The armature shaft runs parallel with the side members of the chassis and is slightly up-tilted at the forward end, where it is attached to a cross-member of the frame. A feature of these trucks lies in the rear suspension; the semi-elliptic springs are attached to the rear axle in the ordinary way, but the distance between the springs is less than the width of the chassis, owing to the shackle brackets being attached slightly inboard. The available loading space of the smaller model is 7 feet 6 inches, while the larger model is 10 inches longer for the same width. The overall length of the K10 type is 129.5 inches, extreme width 68 inches, and can be turned in a circle 40 feet in diameter. The smaller type is 10 inches longer overall than the other, this being accounted for by the extra loading space, with the same width, namely, 68 inches, and can be turned in a 48-foot circle.

Atlantic

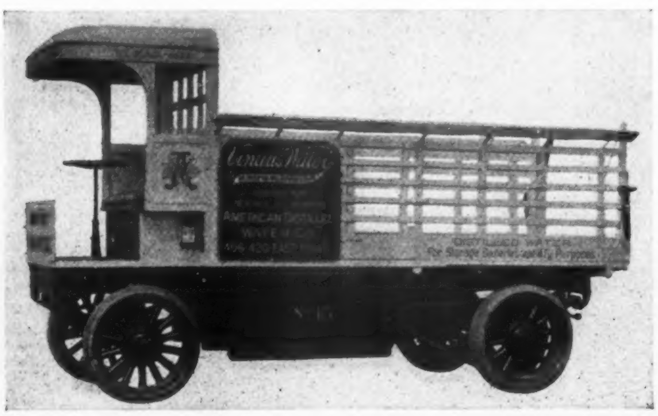
¶ Atlantic trucks are made in four sizes with a carrying capacity of 1, 2, 3.5 and 5 tons, respectively. This company started to manufacture last March. The four chassis are similar in design and only such necessary variations have been made, taking into consideration the difference in weight and loading capacity. No radical feature of design is incorporated.

The batteries, composed in all models of forty-four cells of the Hycap Exide make or sixty cells of the Edison type, are carried in cradles suspended beneath the frame, permitting of loading and unloading from either side. The controller is situated beneath the driver's seat, the operating lever being placed within easy reach of his left hand. The accessibility thus obtained renders inspection and renewal at any time a very simple matter, the current from the battery being fed through well-insulated wires of liberal carrying capacity. Four forward and two reverse speeds are provided. The motor is suspended from a frame cross-member back of the jackshafts, which are situated amidships, the final drive being effected from the sprockets on the jackshafts to the rear wheel hubs by means of roller chains. The motor shaft, which runs on ball bearings, is fitted with a sprocket, and the power is transmitted to the differential sprocket by an inclosed Morse silent chain. Particular attention has been paid to the suspension of the vehicles, imported silico manganese being used for the springs, which are of the semi-elliptic type and are composed of a comparatively large number of thin, highly-tempered leaves. Two independent brakes are provided, the service brake of the expanding type operating on the rear wheel drums and the emergency brake of the contracting type fitted to the center of the countershaft. Both are pedal operated.





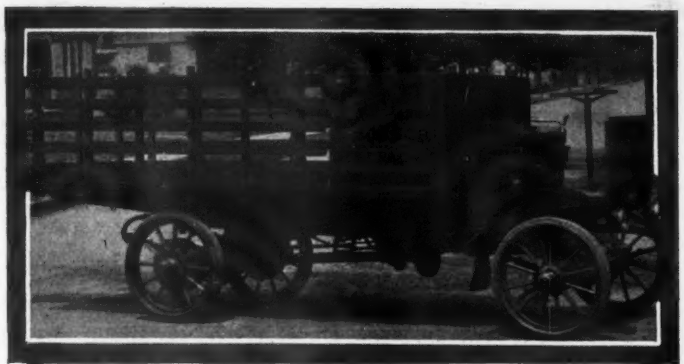
Upper—C. T. 5-ton vehicle with deep stake body and canopy
Center—Example of the C. T. 2-ton type for delivery purposes
Lower—$2\frac{1}{2}$-ton Walker wagon for department store delivery

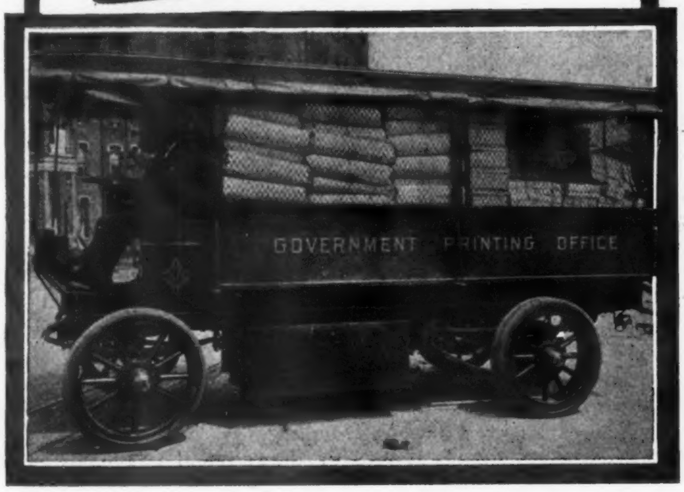


$3\frac{1}{2}$-ton General Vehicle with deep express body

Baker

¶ These trucks, manufactured by the Baker Motor Vehicle Company, are made in five models ranging from the 500-pound to the 3.5-ton truck. The five models are as follows: Type W, 500 pounds; Type X, 1,000 pounds; Type O, 2,000 pounds; Type U, 4,000 pounds, and Type C C, 7,000 pounds. Perhaps the most conspicuous model is the C C type, intended to carry 7,000 pounds. The detailed construction of this chassis does not show any radical departure from standard practice, with the exception that the side driving chains are inclosed in oil baths, which keep the chain running free from the abrasive effects of dust and





Upper—Ohio 1-ton truck for general contracting work
Center—Baker 1-ton vehicle with body suitable for special laundry work
Lower—Baker 2-ton truck with body suited to work in government printing service

mud. The batteries in all vehicles are underslung in a substantially braced cradle and consist of forty-two cells for standard equipment, subdivided into small trays, or when Edison batteries are specified sixty cells of this type are used.

The controller, of the continuous-torque drum type, is inclosed in an aluminum case attached to the front part of the chassis under the floor-boards, and is operated by a lever beneath the steering wheel. A special safety device prevents accidental slipping into reverse. All models from 1,000 pounds upward have five forward speeds and three reverse. In these models the motors are suspended from a tubular cross-member of the frame. The power is transmitted to the inclosed differential by a Renold silent chain, inclosed in an extension of the differential cover. The final drive is by two roller chains from the jackshaft sprockets to the rear wheels, the alignment of the rear axle being taken care of by means of radius rods with easy adjustment. Two brakes outfitted, one of the internal expansion type working on the rear wheel hub drums and operated by a lever, and the other, also internal expanding, on the countershaft and drums, pedal operated. In order to facilitate lubrication of the various working parts, provision has been made whereby this operation can be performed from the exterior of the chassis without disturbing the body or load.

Champion

¶ These vehicles, manufactured by the Champion Electric Vehicle Company, are offered in two capacities, 750-1,000 pounds and 2,000 pounds. The batteries of these trucks are carried upon the chassis frame under the driver's seat. The battery equipment of the 1,000-pound chassis is twenty-six cells lead, eleven plates, or forty cells Edison A4, and that of the 2,000-pound chassis forty-four cells lead, thirteen plates, or sixty cells Edison A4 or A6 type.

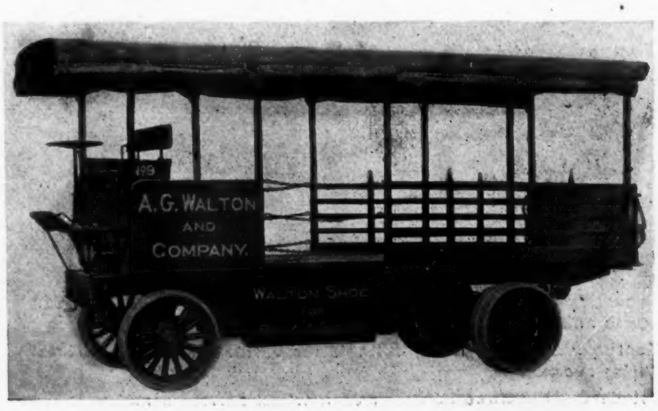
The motor is suspended from a cross-member of the frame about the center of the chassis, and the power is transmitted to a pressed-steel rear axle, the first reduction being obtained by bevel gear and the second by spur gears. This type is common to both models. The purchased has the option, however, in the larger model of chain drive. In this case the first reduction is by silent Morse chain from the motor to countershaft, and thence to the road wheels by roller chains. The wheelbase of the small model is 86 inches, and 100 inches for the larger. The maximum speed of both trucks is 12 miles per hour.

Commercial Truck

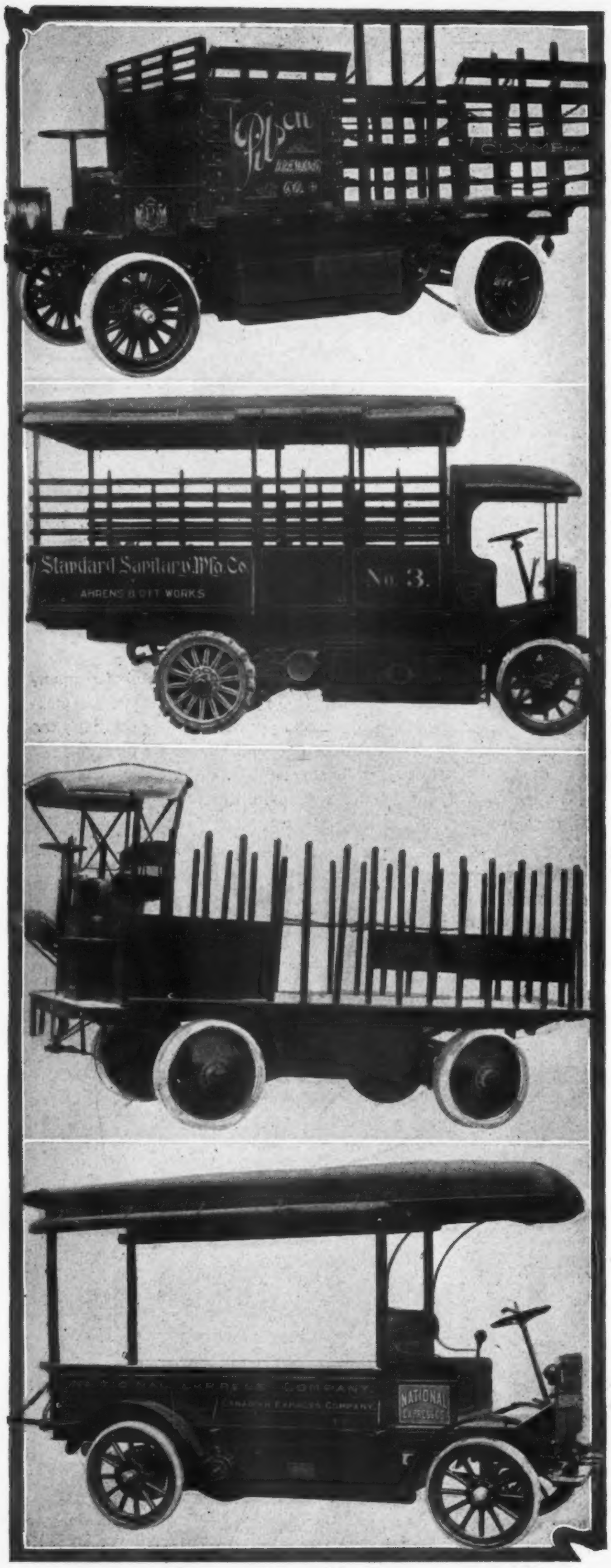
¶ The trucks manufactured by the Commercial Truck Company of America comprise models for the following carrying capacities: 500 pounds, 1,000 pounds, 2,000 pounds, 4,000 pounds, 7,000 pounds and 10,000 pounds. The battery equipment of all models consists of forty-two lead or sixty Edison cells, the number of plates and type depending upon the service requirements and the size of the truck. The battery unit is suspended on all models from the main frame in a cradle suitably trussed both front and rear.

A feature of these trucks lies in the location of the controller, which is situated at the base of the steering column and operated by a wheel immediately below the steering wheel. Three forward speeds are furnished on the 500 and 1,000-pound chassis, while all the larger models are fitted with four speeds forward; two reverse speeds are provided in all cases.

There are three distinct types of drive represented in this line of trucks, the differences being such as to necessitate a separate description of each. Dealing with the lightest model first, comprising the 500 and 1,000-pound wagons, the final drive is by Hindley worm. The motor and rear axle form one unit, the power being transmitted to the jackshafts with one single reduction. The entire mechanism is completely inclosed, running in oil. The rear axle is of the floating type, the road wheels being mounted on Timken bearings. In the event that some repairs may be found necessary at any time, such as when it is proposed to overhaul the power plant, the entire rear construction can be removed in a very short space of time and a new



General vehicle 5-ton truck for varied services



Waverley 5-ton truck with brewery stake body. Note wide rear tires and strong wheels

Kentucky 3.5-ton vehicle, suitable for various industries. Note long overhang

Couple-Gear with stake body; each wheel carries a motor

National Express Company's Detroit wagon with canopy top

or spare one substituted, thereby avoiding the necessity of laying up the truck. Internal expansion brakes are fitted to drums on the driving wheels controlled by a pedal. An electrical emergency brake is provided. The mileage claimed for these models ranges from 40 to 60 miles on a charge.

The points of variance between the preceding type and the 1 and 2-ton chassis lie in the form of drive. The rear axle is in the form of a double U-beam structure, the two beams being parallel to each other with the motors, of which there are two, placed between the beams and supported by them. The motors are geared directly to each of the rear wheels by a spur gear. The claim for this type of drive is that equal driving power is available at both wheels, thus obviating one of the drawbacks of differentially-driven wheels. The wheel that has the stronger footing in the case of the double-motor drive will revolve equally as well as the one that has the poorer footing. The motors are attached to gear-cases of crucible steel, the chassis springs finding a seat upon the top of the cases and the extension of the cases form the axle spindles. The armature shaft has a pinion attached at one end which meshes with three spur gears, these latter being carried on studs integral with the drive shaft, which passes through the axle spindle and engages with the wheel hub by means of a square coupling.

The 3.5 and 5-ton types are fitted with four-motor, four-wheel drive. The two axles are steel forgings, made in two parts, separated by a spacer. The motors are held in position between the axle arms by means of bosses bored out to receive the trunnions which are part of the motor casing. Suitable bracing is provided to keep the motors in line. Each motor shaft is furnished with a driving pinion, which engages with a larger pinion upon a common axis with the main driving pinion. This latter engages with an integral bolt bolted direct to the wheel.

Detroit Electric

¶ The Anderson Electric Carriage Company's line consists of four types. The three types manufactured heretofore are continued, namely, 1,000, 2,000 and 3,000-pound vehicles, to which has been added a 7,000-pound model known as No. 7. The No. 7 truck is equipped with Edison batteries only, there being sixty cells of the A10 type. These cells are carried in four roller cradles, in a sheet steel compartment so arranged as to pull out at the sides on a special metal track. The operation can be performed by one man by taking off the cover on the side, attaching the metal tracks to slots in the lower corners and suspending them with hooks at the upper corners, thereby providing a shelf for carrying the batteries when withdrawn for inspection.

The disposition of the cells on the 1,000, 2,000 and 3,000 chassis is by placing eight trays parallel to one another with eight cells in each tray, except one, in which there are only four. In model No. 7 there are twelve trays with five cells in each.

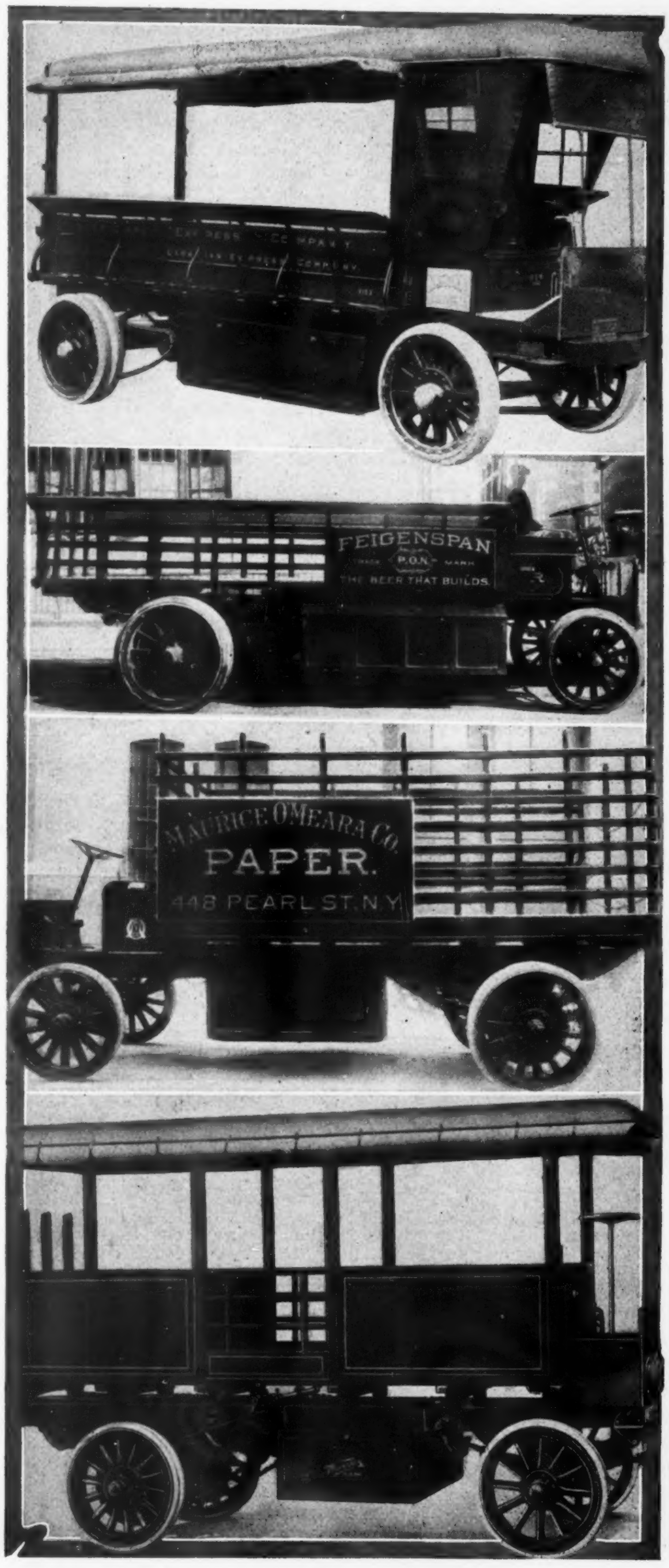
The controller is of the continuous-torque type, operated by a lever carried below the steering wheel. In all models the motor housing is formed integral with two strap arms resting on two cross-members of the frame. The power is transmitted to the differential by means of inclosed Renold silent chain. The final drive is through sprockets and double roller chains, S. K. F. self-aligning ball bearings being used in the countershaft brackets.

The frame on the new No. 7 model is 6-inch channel pressed steel, tapering from just in front of the center cross-member to a point immediately behind the driver's seat, at which point another cross-member is attached. This gradual sweep eliminates abrupt bends in the frame, thereby adding greatly to its solidity. The two brakes are operated by pedals, the service on the rear hubs and the emergency on drums attached to the jackshafts.

Fritchle

¶ These vehicles are manufactured by the Fritchle Automobile & Battery Company in one model for commercial purposes, with a carrying capacity of 1,000 pounds. The batteries, which are of Fritchle manufacture, are suspended amidships, consisting of

thirty-two cells. The controller, placed under the driver's seat, is operated by a lever, giving five forward speeds. The motor is placed across the chassis and suspended from a cross-member, driving the large sprocket, attached to the differential in the rear axle, by single roller chain. The chassis frame is made of wood sills and treated so as to render them impervious to acids, the suspension being taken care of by elliptic springs, front and rear, with two reach rods connecting the front and rear axles holding them in line. The wheelbase is 100 inches. Two contracting band brakes are provided on the rear wheel hubs in addition to an electric brake.



Detroit electric with typical express body and good driver's protection
Atlantic 5-ton vehicle in brewery service
Atlantic 3.5-ton type with body suitable for the paper trade
Waverley 2-ton model with side doors

G. M. C. Electrics

¶ These vehicles are manufactured by the General Motor Truck Company in the following sizes: 1,000 pounds, 2,000 pounds, 3,000 pounds, 4,000 pounds, 6,000 pounds, 8,000 pounds, 10,000 pounds and 12,000 pounds, respectively described as Models 1, 2, 3, 4, 6, 8, 10 and 12. These again are subdivided each into three types according to the length of the wheelbase, the shortest being type A, the medium type B and the long wheelbase type C.

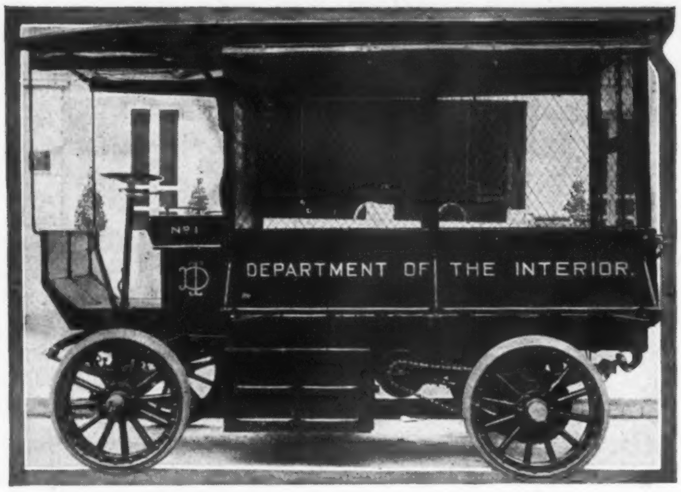
Three outstanding features distinguish these trucks from others on the market. One is a spring steel tempered blade propeller shaft to transmit the power from the motor to countershaft. The second is a short hood in front of the vehicle, inclosing the controller, ampere-hour meter, safety switch and light switches. The third is that the storage battery is placed on the chassis under the driver's seat. The battery, consisting in all cases of forty-four lead or 60 Edison cells, is carried above the frame, access to which is obtained by raising the seat cover. The cells are carried in single or multiple trays removable through the side panels. The steering pillar is inclined towards the rear, and carries a rod connected at the lower end with the controller and at the upper extremity with a lever above the steering wheel. The movement of the lever forward produces the five forward speeds and two reverse is obtained by moving the lever in the opposite direction. The motor is suspended from cross-members of the frame at the rear of the countershaft, the drive being transmitted as has already been explained by means of a spring steel blade. An expanding brake is fitted to the drive shaft and the conventional internal expansion brakes are fitted in the rear wheel hub drums. The semi-elliptic springs are supplemented at the rear of the chassis by coil springs being interposed between the chassis frame and the axle seats.

General Vehicle

¶ The General Vehicle Company manufactures six models, including chassis capable of carrying 750 pounds, 1,000 pounds, 2,000 pounds, 4,000 pounds, 7,000 pounds and 10,000 pounds. This season's models will not be marked by any material changes in design. The same general features are incorporated in all of the models, only small alterations in design being made to take care of the differences in load capacities. The batteries, consisting of forty-four cells, are suspended amidships under the main frame by stout section supports, loading and unloading being effected from either side. The controller is placed under the driver's seat, operated by a lever to the left of the driver. The motor is centrally located towards the rear of the chassis, the power being transmitted to the countershaft by an inclosed Morse silent chain, and thence to the rear wheels by double roller chains. An internal expansion brake is located in the drums of the rear wheels, which run on roller bearings.

Jatco

¶ Jatco vehicles, manufactured by the Joliet Auto Truck Company, are made in two models, one a 1,000-pound chassis, Model C, and the other a 1-tonner, Model D. The two are identical in dimensions as regards loading space, wheelbase and total overall length. The smaller chassis weighs 2,600 pounds and the larger model 3,000 pounds. Motive power is transmitted to the differential by silent chain and from the jackshafts by roller chain. Batteries with a 165-ampere-hour capacity, containing thirty and forty cells respectively for the model C and D, and suspended under the chassis. They are capable of supplying sufficient current for 50 miles for the smaller and 40 miles for the larger truck on a single charge. The control lever of the 1,000-pound



Baker 1-ton wagon for government service

chassis is located on the top of the steering wheel, and in the 1-ton chassis it is situated on the right of the driver's seat. Two independent pedal-operated brakes are fitted.

Lansden

¶ **The Lansden Company builds five models, ranging from 1,000** pounds to 5 tons. The design of all the models is identical, the only differences being in the sizes of the parts, which are proportionate to the carrying capacity. The new models carry the following loads: 1,000 pounds, 1 ton, 2 tons, 3.5 tons and 5 tons.

Edison batteries, used on all models, are suspended from the frame in a steel cradle with aluminoid covering, suitably lined with insulating material. The side doors are hinged at the bottom and when lowered form an extension tray to permit the batteries being partially withdrawn. The trays are mounted upon steel rollers, which run in channels. With the exception of the 1,000-pound wagon, in which the cells are arranged in ten rows with six cells in a row, the four models have the cells arranged in twelve rows with five cells in a row.

The controller is fitted in front of the chassis below the floor-boards and is of the eight-finger continuous-torque type, the operation of changing the four forward and two reverse speeds being effected by a lever under the steering wheel. Around the inclined steering post there is a tube, connected at the top end with the control lever, and at the bottom to an arm carrying an arc-shaped gear which engages with its mate on the controller shaft. Each speed is determined by notches in the quadrant upon which the change-speed lever works, and to prevent an inadvertent dropping into reverse it is necessary to slightly raise the lever. The maximum speeds of the respective models, starting with the smallest, are: 14, 12, 10, 9 and 8 miles per hour. The 1,000-pound and 1-ton chassis are capable of covering 60 miles per charge under normal conditions, and the three larger types average approximately 50 miles.

A series-wound General Electric motor is suspended from a U-section pressed steel cross-member, slightly forward of the rear axle, with the armature shaft parallel with the side members of the frame. The motor housing is bolted to an extension of the differential casing, by which means the motor and differential are held in alignment. The armature shaft, carrying the driving bevel pinion, is extended forward into the differential housing and a brake drum is attached to the shaft between the two units. In order to prevent any lubricant leaking from the differential and finding its way into the brake mechanism, a stuffing box is used. Side strains are obviated by the three-point suspension. It is claimed that the motor is capable of withstanding a 300 per cent. overload for a period of 30 minutes. Ball bearings are employed in the motor and roller bearings in the differential. The final drive from the inclosed jackshaft is by chains. The service brake on the armature shaft is operated by a pedal which is connected with the controller, so that the act of braking automatically cuts off the current to the motor. The emergency brake, pedal operated, is placed in the drums of the rear wheels, and can be held in any desired position by means of a ratchet.

M. & P.

¶ Two chassis models are manufactured by the M. & P. Electrical Vehicle Company, resembling each other in general characteristics and intended to carry 1,000 and 2,000 pounds. A resumé of one of these chassis will therefore be indicative of the other. The Westinghouse motor is suspended beneath the chassis frame directly under the driver's seat. In order to make room for the drive shaft from the motor to the differential, the battery box is made in two compartments, suspended from the side-members of the chassis frame. The Gould batteries are assembled in four trays, with ten cells per tray and are reached through a door in the floor. A rubber curtain protects them. Battery removal is from the sides. The controller of the continuous-torque type, operated by a lever on the left, gives four forward speeds and two reverse. The drive shaft from the motor to the differential is fitted with universal joints at each end to relieve any strains due to frame distortion. Final drive is effected by roller chains. Internal expansion brakes are fitted to the extremities of the jackshafts as well as to the rear wheel hubs, each set being operated by independent pedals. The chassis is of standard steel channel, with channel steel cross-members, hot riveted, and the suspension is by elliptic springs. The length of the loading space is 80 inches on the 1,000-pound chassis and 90 inches on the 2,000-pound chassis; the wheelbase is correspondingly longer for the larger chassis, namely, 112 inches, while that of the smaller type is 100 inches. Solid tires, fitted to standard S. A. E. rims, are supplied as part of the regular equipment.

Urban

¶ The Kentucky Wagon Manufacturing Company builds trucks in four sizes—of 1,000, 2,000, 4,000 and 7,000-pound capacity. All models are similar. The batteries are carried forward of the jackshaft beneath the frame. Access to the cells may be had from either side of the car or from the top. The steering column is inclined 30 degrees and the controller is operated by means of a lever mounted just beneath the steering wheel. This lever operates in the lower slot of a gate for the four forward speeds and in an upper slot for the two reverses, accidental movement of the lever being prevented by means of a thumb latch. The controller handle serves to rotate a tube, concentric with the steering column, being coupled to the controller at the lower extremity by a drag link. The controller, lighting and emergency switches, ampere meter, etc., are mounted in a short shroud, which is part of the chassis. The switches are mounted upon a panel at the rear of the shroud, forming as it does a dashboard, and by removing an aluminum panel the controller is readily accessible.

A General Electric motor is supported under the chassis immediately forward of the rear axle, whence the power is transmitted to the differential by silent chain, inclosed in an oil-tight aluminum casing. A cast steel housing is provided for the jackshaft unit. Nickel steel heat-treated gears and shafts are used to convey the power to the sprockets at the ends of the jackshafts, the final drive being effected by roller chains. The radius rods are arranged to provide for universal movement of the axle in relation to the chassis frame, thereby relieving the latter of undue torsion strains. Service brakes placed on the extremities of the jackshafts are operated by pedal, and emergency brakes expanding in drums on the rear wheels are operated by a ratchet-retained lever.

Walker

¶ The vehicles made by the Walker Vehicle Company are distinctive in design. Five models are listed, namely, Model F, 750 to 1,000 pounds; Model 7, 1,500 to 2,000 pounds; Model B,

3,000 to 4,000 pounds; Model D, 4,000 to 5,000 pounds, and Model E, 7,000 pounds. The general appearance of the vehicles is distinctive through the wheels, both front and rear being made of pressed steel disks with radial corrugations in the form of spokes.

The battery, the number of cells depending upon the size of the truck, is suspended by means of substantial cradles of T-section steel, the removal being effected from either side. Provision is also made for inspection from above through a trapdoor and cover. The rear axle houses the entire power-transmitting mechanism, the whole unit being known as the Walker balance gear. The power is furnished by a single motor having a hollow armature shaft mounted on ball bearings. The armature shaft drives the differential, which in turn drives the jackshafts. These carry at their outside extremities pinions which transmit the power through idler gears to large internal gears fastened to the driving wheels at a point near the outside periphery.

A U-shaped cover over the rear axle casing affords ready access to the motor at any time. By removing the hub caps, withdrawing the jackshafts and unbolting the saddles that hold the armature shaft in position, it is possible to remove the armature with a minimum of trouble. The suspension of these trucks is worthy of mention. The forward end of Models F, C and B is suspended by means of reverse semi-elliptic springs placed transversely across the chassis, the alignment and distancing of the front axle being maintained by a triangular reach extending from the extremities of the axle to the rear support of the battery box, where the two ends unite in a ball joint, permitting the axle to assume any angle with the road surface without being subjected to twisting strains. The rear suspension on all models is of the three-quarter platform type. The steering is vertical and the speed control is operated by a lever to the driver's left. The braking mechanism is entirely confined to the rear wheel drums.

Waverley

¶ Electric commercial vehicles manufactured by the Waverley Company include a 1,000-pound delivery wagon, 1, 2, 3.5 and 5-ton trucks. The 1,000-pound wagon is an enlarged model of last year's 600-pound chassis. Some minor changes have been made in the 1-ton model. The 2, 3.5 and 5-ton models are all new.

The battery in all models consists of forty-two cells, the number of plates varying according to the size of truck and is suspended from the chassis in a steel cradle, strengthened by T-section hoops and steadied by the guy rods between the front and rear of the base and the main frame.

The method of drive on the 1,000 and 2,000-pound trucks is identical, being the Waverley patented shaft drive with two reductions, the motor being hung slightly forward of the rear axle. The armature shaft is extended at both ends, one end carrying a brake drum and the other the driving pinion. The motor housing is also extended to inclose the silent chain which drives the secondary shaft. The latter is parallel with the rear axle and carries at its opposite extremity a herringbone gear which meshes with the main differential pinion, the power being transmitted to the rear wheels by dogs interposed between the ends of the jackshafts and the castellated hub ends.

Turning to the larger models, these possess all the earmarks of carefully studied construction, having a clean-cut, substantial appearance. The chassis are of channel section steel with cross-members of like material, securely riveted together and reinforced by angle and flitch plates. The motor is supported behind the rear axle by two semi-circular brackets passing below, while steel bands hold the unit in position above. These upper brackets are hinged, thus facilitating the removal of the motor at any time. An intermediate shaft fitted with universal joints at either end transmits the power to the differential, which is housed in a pressed steel casing. Back and front covers are fitted to the casing, permitting the removal of the entire differential without disturbing the anchorage of the casing. A truss bracket is fitted slightly off center, connecting the differential casing to a cross-member of the frame, in addition to two radius rods, which take the thrust of the rear axle and maintain the distance necessary for the final chain drive. All the power wiring is carried in a frame especially for the purpose, running the entire length of the chassis, thus preventing it from deteriorating through friction, vibration, etc. The controller, located under the driver's seat in all the larger models, is of the continuous-torque type and permits of an equal number of speeds forward and reverse. As this works in a quadrant there is no likelihood of the driver inadvertently passing from forward into reverse. Two pedals, one on either side of the steering pillar, control a set of brakes, the service brake being housed in the rear wheel drums and the emergency at the extremities of the jackshafts. The front end of the chassis is protected by a bumper of stout U-section.

Ward

¶ Ward cars are built in four sizes by the Ward Motor Vehicle Company. These four chassis are entirely new models and are known by letters, which denote the carrying capacity as follows: EA, 1,000 pounds; EB, 2,000 pounds; EC, 3,000 pounds, and ED, 8,000 pounds, the capacity being exclusive of body and driver. The main idea has been to develop a line of trucks of uniform design, the appearance and design of the smaller vehicles being replicas of the larger models on a smaller scale. By this means each part can be numbered, and by stating the model it is possible for a customer to easily obtain new parts when needed.

The battery crade is substantially constructed of steel, the base being formed by cross-members of T-section steel on which the battery tray slides. The standard battery equipment consists of forty-two cells of the lead plate type or sixty cells of the Edison. The continuous-torque type of controller is located beneath the driver's seat. It gives four forward and two reverse speeds and is operated by a handle placed at his left.

The motor is a shunt-wound General Electric, suspended over the rear axle by suitable braces to two cross-members of the main chassis frame. The power is transmitted to the countershaft by a silent chain of the inverted tooth type, inclosed in a dustproof casing, and thence through double roller chains to the rear wheels. The speeds at which these vehicles are intended to travel have been set so as to keep the cost of upkeep low. Suspension is by semi-elliptic springs front and rear. U-section steel is used for the side-members of the chassis frame. This is being slotted midships to allow the compensating cross-rod operated by the brake rod and pedal to pass through and thus equalize the braking effort while taking care of any inequality of wear or adjustment.

The wheelbase of the respective models, starting with the smallest, is 84, 96, 114 and 132 inches, and the platform lengths 78, 96, 117 and 144 inches. Ward special electric tires are fitted to standard S. A. E. wheels, which give the purchaser an opportunity of having any tires fitted that he may desire.

Lansden vehicle for the express field

Motor-Generators and Rectifiers

Enable Private Owners of Electrics To Charge Batteries at Home from Alternating Current Mains; Are Also Used in the Public Garage

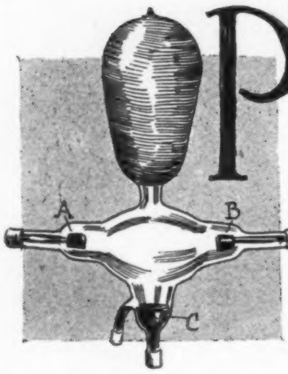


Fig. 1—Mercury bulb on Westinghouse rectifier

PRACTICALLY all the electrical energy produced by power stations at the present time is in the alternating form, that is, the current, instead of flowing continuously in one direction, is given alternate impulses in both directions. The electric vehicle, on the other hand, owing to the fact that it has to carry its energy in the form of a storage battery which only deals with direct current, requires that a direct current source of supply be available when recharging is necessary. In many of the smaller cities the use of the electric vehicle is almost entirely unknown, owing to the absence of public garages where battery charging can be done. Few garages for gasoline propelled pleasure or commercial vehicles have the equipment for renewing the energy of the electric vehicle. In every city of 5,000 population or over in the United States is at least one garage for the gasoline vehicle; in every city of 5,000 population or over there is a central station for the generation of electrical power; some of these central stations have facilities for charging electric vehicle batteries; most have none.

Various devices are in use for the conversion of alternating current to direct current, the most important being the motor-generator or converter, the mercury-arc rectifier, the electrolytic and the electro-magnetic rectifiers. All except the electro-magnetic rectifier, which, owing to its construction, is capable of dealing only with very small quantities of current, can be used for charging the batteries of electric vehicles.

The motor-generator consists of an alternating-current motor mounted alongside a direct-current dynamo or generator and coupled directly to it. When in use the motor is connected up to the alternating-current mains and, once started, there is a constant generation of direct current at the dynamo end of the combined set. Mechanically this type of converter is reliable, but there is a considerable loss of power in the process of conversion, especially in small models, resulting in a rather low electrical efficiency. Nevertheless the motor-generator, or rotary converter, which is the same machine in a different form, is the only practical method of converting alternating current on a large scale. Some efficiency is gained in the rotary converter over the motor-generator in that the former has only one magnet casing and armature. This armature has a winding fitted with collector rings at one end to take the alternating supply, and a commutator at the other end to deliver the direct current. This construction also does away with the difficulty of aligning the two shafts and four bearings of the two units of a motor generator.

The mercury-arc rectifier belongs to the static order of alternating-current converters, having no mechanically moving parts. The first of these devices were sold nearly 10 years ago, and since that time they have been in constantly increasing demand, the chief reasons for this demand being their high efficiency, absence of moving parts requiring oil and grease, and lack of vibration. This type of rectifier is also the cheapest reliable device for charging that has so far been produced. One of the objections raised against it was the presence of the glass tube which contains the mercury arc. It was predicted that this tube would not last, but as cases are known where the same tube has been in operation for 5 years, and the manufacturers of these tubes guarantee an average life of 600 operating hours, the slight cost of renewals need not be feared.

The mercury rectifier in its practical form consists of a glass vacuum chamber shaped very much like the ordinary electric

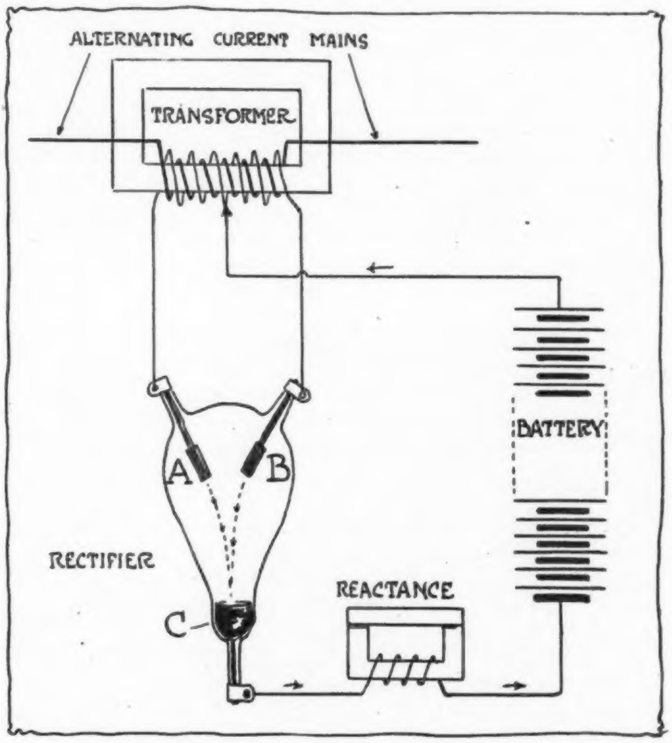


Fig. 2—Wiring diagram of mercury-arc battery-charging apparatus

light bulb except that it is larger, containing two anodes A and B, Figs. 1 and 2, and a cathode C at the base. This latter is the negative pole and consists of a pool of mercury with outer terminal connections. Graphite or iron is generally used for the anodes. The operation of the device depends on the peculiar property of mercury vapor, when of a certain rarefied density to permit current to flow from an anode or positive terminal across the vapor to a mercury cathode, but not in the reverse direction. Why this is so and exactly what happens in the process is not definitely known, but the theory of operation generally held is as follows: All gases are supposed to contain numerous electrically charged particles or atoms called ions. Some of these ions are positively charged and others negatively, and when a high degree of electrical pressure or potential exists between two conductors of electricity separated by a gas or gases such as air, these ions assume a directional flow between the conductors which becomes more rapid as the electrical stress increases, until a point is reached when an arc is formed permitting the current to bridge the gap. The ease with which an arc is formed de-

pends not only on the voltage or pressure of the electrified conductors and the distance separating them but also on the density of the surrounding gas. When in a rarefied state a comparatively low electrical stress can break through. This is what occurs between clouds when lightning appears. The neighboring atmosphere is always rarefied, permitting an arc discharge between the oppositely electrified clouds. When this arc takes place in rarefied mercury vapor it allows current to pass only in one direction, and it was the discovery of this fact which led to its utilization as a sort of separator of the two alternate impulses which constitute alternating current, sending only the impulses of one direction to the battery or for whatever purpose the direct current was required.

When fitted up for battery charging the connections are as shown in Fig. 2. The alternating-current mains are connected to one winding of a transformer and the two anodes of the rectifier are wired across the second transformer winding. A reactance coil is introduced between the cathode at the base of the rectifier and the positive terminal of the battery, and the return wire from the other pole of the battery connects to the center of the transformer winding. Once the arc is formed the following action is taking place: The main alternating current passing around the first coil of the transformer sets up a magnetic state in the rectangular iron frame on which the coil is wound, which in turn induces a flow of current, also alternating, in the second transformer coil connected to the rectifier. The purpose of the transformer is to reduce the voltage of the mains to that which, after being rectified, is suitable for charging the battery. The induced current is now in communication with the mercury vapor through the two anodes A and B. These anodes are alternately positively charged at a rate corresponding with the periodicity or rate of impulses in the main supply, and at each instant of positive charge the current flows through the arc to the mercury cathode and thence to the battery. It will be seen, then, that virtually the arc is oscillating between the two anodes and the cathode, and that the resultant current supply, though unidirectional, is not absolutely "smooth." To neutralize the intermittent character of the current a reactance coil is inserted in the circuit.

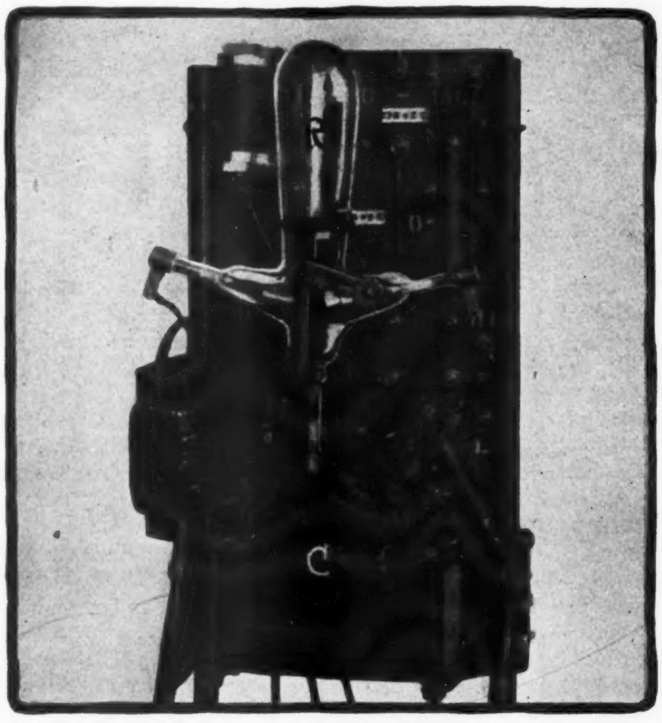


Fig. 3—Swivel-mounting of mercury bulb behind panel of General Electric Company's rectifier

It should be noted that there is a considerable drop of voltage during the process of rectification in the mercury bulb, varying in ordinary sized tubes from 15 to 25 volts. This drop is practically constant with a particular tube, and hence the efficiency of the rectifier can be said to vary with the voltage of the direct current delivered. The higher this voltage the less in proportion is the potential drop of the rectifier.

A line of motor-generator sets made by the General Electric Company and suitable for battery charging is shown in Fig. 3. The motors of these sets may be driven by either single, two or three-phase alternating current, at 60 cycles, and various standard commercial voltages. The capacities range from 0.2 to 10 kilowatts. Standard generators are shunt-wound, designed to deliver 125 volts at full load.

By a novel method of attaching motor and generator frames solidly together, these sets are made very compact and the necessity of a sub-base eliminated. This construction also allows the motor and generator armatures to be mounted on a common shaft, requiring only two end bearings. In all except the smaller sizes provision is made for thorough ventilation of the field coils, armatures and commutators, by a well-directed current of air, thus securing uniform, cool operating temperatures throughout, with consequent improved life of insulation.

Fig. 5 shows the Lincoln motor-generator set, a machine possessing an unusual feature in its ability to supply direct current at two distinct voltages. The low voltage is 75 and the high 115, being designed respectively to charge from twenty-four to twenty-eight-cell lead batteries or forty-cell Edison batteries from the 75-volt terminals, and from thirty-eight to forty-two-cell batteries or sixty-cell Edison from the high voltage end.

The Wagner rotary converter, made by the Wagner Electric Company, St. Louis, Mo., adapted for single-phase work, is shown in Fig. 4. It is a strong, compact design, suitable for fitting at any convenient point in the garage. The armature shaft runs on ball bearings and a belt pulley is provided so that the converter can be used as a motor for power purposes in the

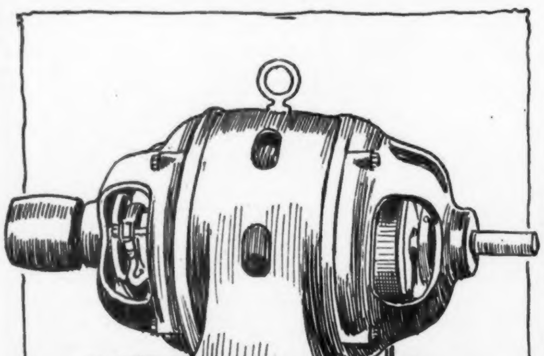


Fig. 4—Wagner rotary converter

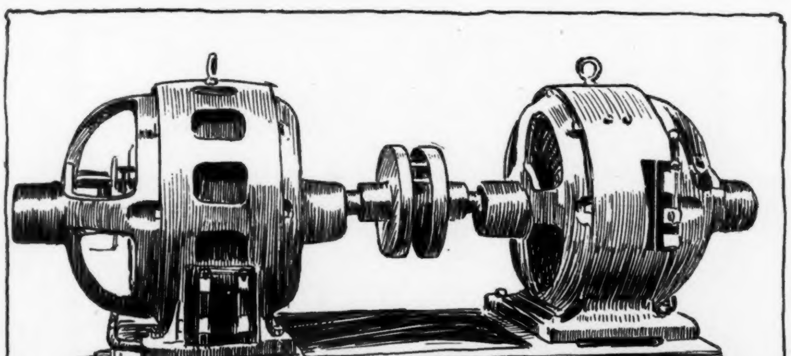
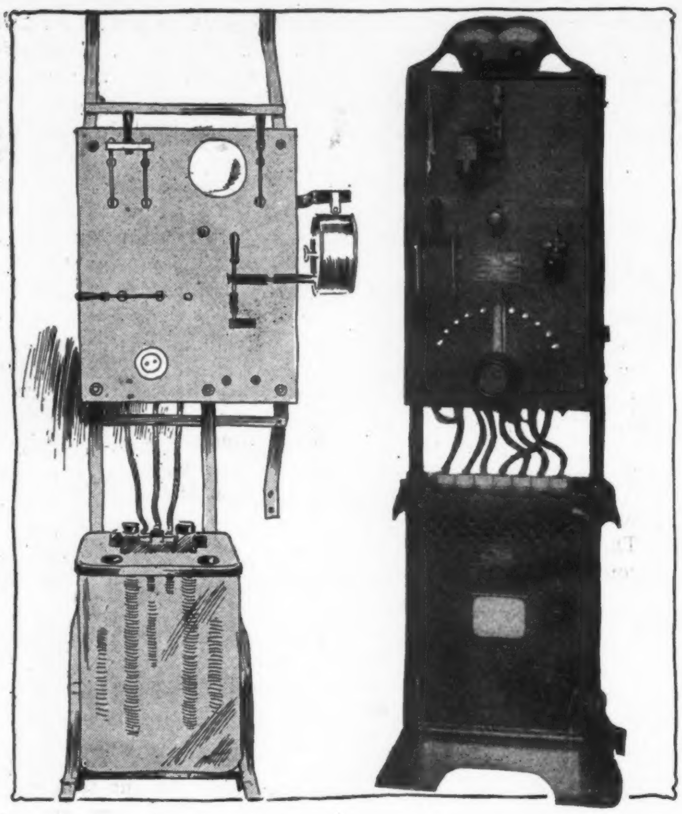


Fig. 5—Lincoln motor-generator set for battery-charging



Figs. 6 and 7—Sirch electrolytic rectifier, and mercury-arc outfit by General Electric Company

garage, such as driving a tire pump, polishing wheel or lathe. As supplied, the equipment includes a control panel fitted with switches which control the amount of direct current delivered to the battery. When required, the makers supply automatic devices for cutting out the battery when fully charged.

Mercury-arc rectifiers are made in two standardized types by the General Electric Company. One of these, called the Runabout type, is shown in Fig. 7. As will be noted, the complete equipment consists of a panel with controlling switches and a main reactance forming a base on which the panel is mounted. The rectifier bulb is supported behind the panel in the manner shown at R, Fig. 3. On the main reactance are various connections to parts of the winding coil, which make it possible to connect the rectifier for various direct-current voltages which cover a range sufficient to charge all ordinary lighter "electrics." The main or compensating reactance stands on the floor and has two receptacles at the top for receiving the pipe supports of the rectifier panel. On the back of the panel is mounted a suitable tube holder for holding the mercury tube. In order to slightly rock the tube, which is necessary in starting, a small handle is provided on the front of the panel, which is connected to a small shaking rod. The panel is equipped with a main or alternating current line switch and single-pole circuit-breaker for protection against overload, and a starting switch for connecting the rectifier temporarily to a resistance load, due to the fact that it is difficult to start a rectifier against the counter electro-motive force of a battery. To start the rectifier the starting switch is held down with one hand while the tube is rocked with the other, and as soon as the tube starts, which is indicated by a greenish-blue light, the starting switch is released, and by means of a spring is transferred to the upper position, and the storage battery, to which the rectifier is connected, is automatically thrown on.

To obtain a regulation of the charging current a reactance coil C, Fig. 3, is connected in series with the alternating-current supply. This coil has eleven taps connected to as many buttons of a semi-dial switch, similar in many respects to the ordinary rheostat switch. This makes it possible to efficiently vary the charging current and voltage over the entire range required by any battery which the rectifier is designed to charge.

This rectifier is designed for operation on 60-cycle, 110 or 220-volt alternating-currernt supply. It may by slight modifications, however, be operated on lower frequencies than 60 cycles. From 220 volts the rectifier will charge from sixteen to forty-four cells of lead plate battery or twenty-five to sixty cells of Edison battery, and from 110 volts it will charge from fifteen to thirty-two cells of lead battery or twenty-five to forty cells of Edison, at a maximum charging rate, depending upon the capacity of the rectifier, which may be 30, 40 or 50 amperes.

Where more than one voltage battery is to be charged in a private garage and it is not convenient to change the connections frequently, the Universal or standard battery charging rectifier is supplied by the General Electric Company. This set is made in five sizes, or 10, 20, 30, 40 and 50 amperes capacity, and in direct-currrent voltages ranging from 10 to 100 when operated from 110 volts alternating current, and from 10 to 175 volts when operated on 220 volts alternating current. This rectifier is suitable for operation on 60 cycles or higher, but special sets of the same design can be furnished for lower frequencies.

The efficiency of these rectifiers at 60 volts direct current is about 70 per cent.; at 70 volts, 75 per cent.; at 100 volts, 78 per cent., and at 175 volts, 80 per cent.

The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., builds mercury rectifier outfits in three models suitable for the private owner's garage. Each of these models consists of a special Cooper-Hewitt mercury bulb shown in Fig. 1, and stationary regulating apparatus, all contained in a ventilated iron case. At the top of the case two dial switches are fitted for regulating the charging current. The types are listed as Type AN, Type AA and Type AE. In Type AN an automatic switch is included, which cuts down the charging current as the charge proceeds, producing the "tapering current characteristic" desirable for lead batteries. Type AE is specially designed for charging Edison batteries which require a more constant rate of charge called the "flat current characteristic." The two first types are made in two sizes, either for ten to twenty-four cells or for twenty to forty-four cells. The maximum charging current is No. 0 amperes. The outfit for Edison battery charging is suitable for twenty to fifty-four cells, with a maximum current of 50 amperes. All these outfits are suitable for alternating-current circuits of 110 or 220 volts.

The Sirch rectifier shown in the drawing, Fig. 6, belongs to the class of electrolytic rectifiers. Here the unidirectional current is obtained by the chemical action between electrodes suspended in a special aqueous electrolyte contained in the glass cell at the base. No rheostat or transformer is employed. Back-discharging of the battery is impossible with this device, and should the main line current be interrupted at any time, charging of the battery is automatically taken up as soon as the main current is resumed.

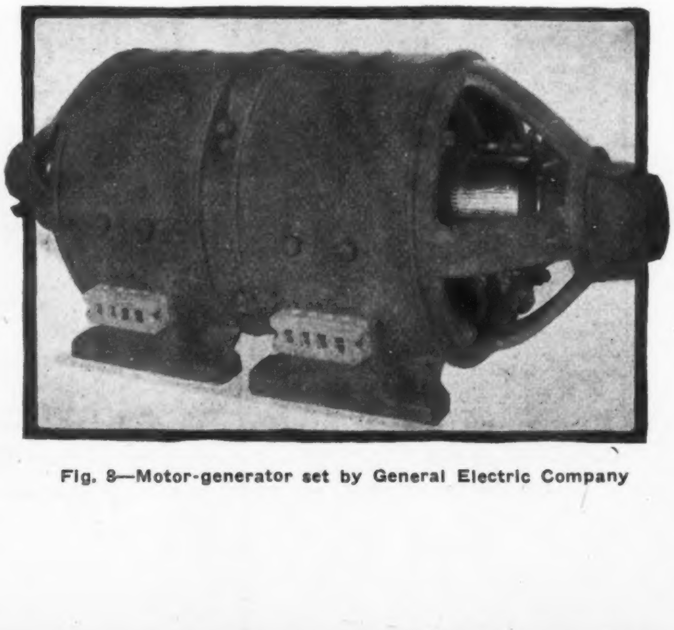


Fig. 8—Motor-generator set by General Electric Company

Rheostats for Battery Charging

Safety Devices a Feature of Latest Designs—Solenoid-Operated Rheostat for Automatic Regulation of Current—Cast Iron Grid Type of Resistance Predominates —Other Types Are Enameled Wire and Compressed Graphite

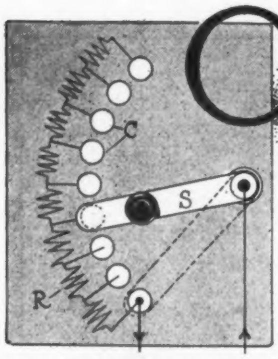


Fig. 1—Outline of rheostat

ONE of the requirements of efficient battery charging is that the charging current be of a certain voltage, determined by the number of cells forming the battery to be charged. And as most direct current supplied by electric power stations is higher than that required for this purpose it is necessary to adopt some means of reducing the main voltage to the desired amount.

There are two ways of accomplishing this reduction. A motor generator may be used, having a motor to take the higher voltage driving a generator to supply the lower; or resistances may be inserted in the circuit. Where the voltage of the supply mains is high, over 200 for example, the motor generator is the more economical method. Below this figure resistances are suitable. Either method represents a loss of energy depending on the voltage drop and may be considered therefore as an undesirable necessity.

The charging of batteries also requires that provision be made for varying the current throughout the charge. When a battery is connected up to a circuit and charging proceeded with, the gradual rise in the battery voltage causes the charging rate to decrease. In some cases this is desirable but the charging of Edison batteries and the periodic boosting or soaking charges which are beneficial to lead batteries demand a more constant charging rate and this can only be obtained by the use of regulating resistances or rheostats inserted in the circuit.

Lead batteries in use on electric vehicles range in size from 24 cells to 40 cells while Edison batteries are generally either of 40 cells or 60 cells. The voltage of the charging current required for all sizes extends from 62 volts in the smallest battery to about 110 volts in the largest. A lead battery of 24 cells requires a charging voltage of 62 volts; 28 cells require 72 volts, and 86 cells 104 volts. The current to charge 40 cells of the Edison type should be at 74 volts and for 60 cells at 110 volts. It will be seen, therefore, that a public garage, in order to accommodate its charging outfit to all these sizes and types of battery must, if only one voltage of supply is available, be provided with a large number of rheostatic resistances.

Fig. 1 shows diagrammatically one of these devices in its essential form. It consists of a switch arm S, the pivot of which is in electrical connection with the circuit and a series of contacts C arranged radially in the path of the switch arm, connected to a number of resistances R. The lowest of these contacts forms the other connection with the main circuit. By moving the switch arm downward over the contacts the resistances are cut out step by step until the final contact is reached when the current supply crosses the switch arm and no resistance is in circuit.

The capacity of a rheostat depends on the ohmic resistance of its units and the amount of amperes it can carry without overheating. Various metals are used for resistance material, iron being, perhaps, the most common. Iron or alloys may be used in the form of wire wound on an insulating core or simply suspended as a spiral in the air; but this method has been largely superseded by the use of flat grids of cast iron which present a large surface to the air for the dissipation of heat and are also constructionally convenient.

The Electric Products Company, Cleveland, O., manufacture automatic rheostats which are suited to the requirements of the private owner. Two of their standard types are shown in Fig. 2. Each outfit consists of a control panel supported on angle-iron uprights, behind which is mounted resistances of the castiron grid type. The instruments on both types are: A, a volt ammeter fitted with automatic cut-off mechanism; B, the main hand switch; C, automatic circuit breaker; and D, the charging rheostat. The automatic cut-off A is provided with two pointers. One of these is set at a point on the scale representing the fully charged condition of the battery and as the charge progresses the other pointer moves over until the two coincide when the charging circuit is automatically cut off. The two pointers remain in contact as a sign to the user that the batteries are fully charged. The battery-charging outfit shown to the right of Fig. 1 has been specially designed to produce automatically a constant charging current, such as is required by Edison batteries, by means of the solenoid-operated rheostat E. This switch automatically raises the charging rate as the battery voltage increases in such a ratio that the resulting current is constant. These charging sets occupy a floor space of 18 inches by 20 inches and are built for 30 or 50 amperes at 110 or 220 volts and charge from 10 to 44 cells of lead battery or from 20 to 70 cells of Edison batteries.

Another type of rheostat suitable for the private garage is shown in Fig. 3. These sets are made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., and consist of two

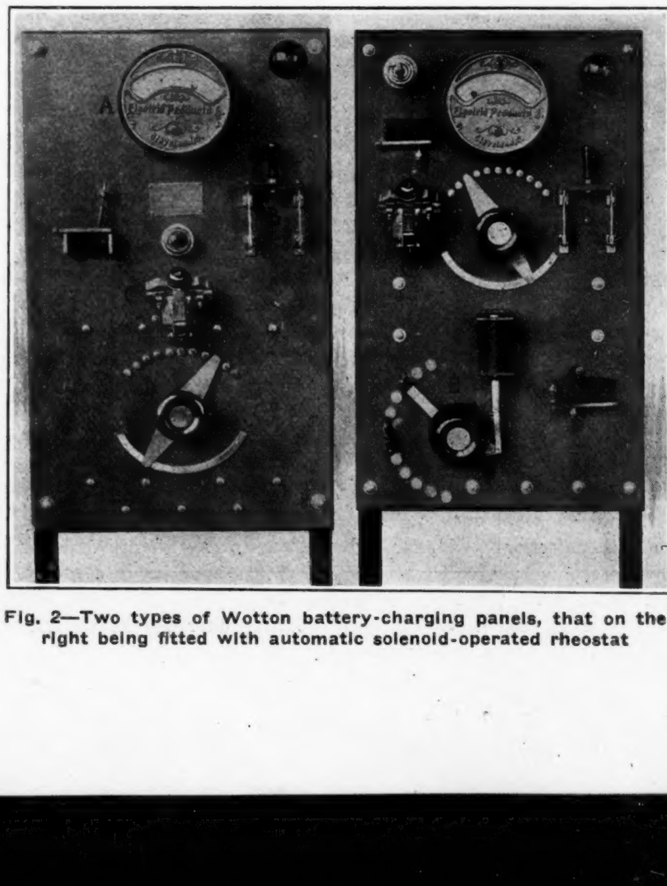


Fig. 2—Two types of Wotton battery-charging panels, that on the right being fitted with automatic solenoid-operated rheostat

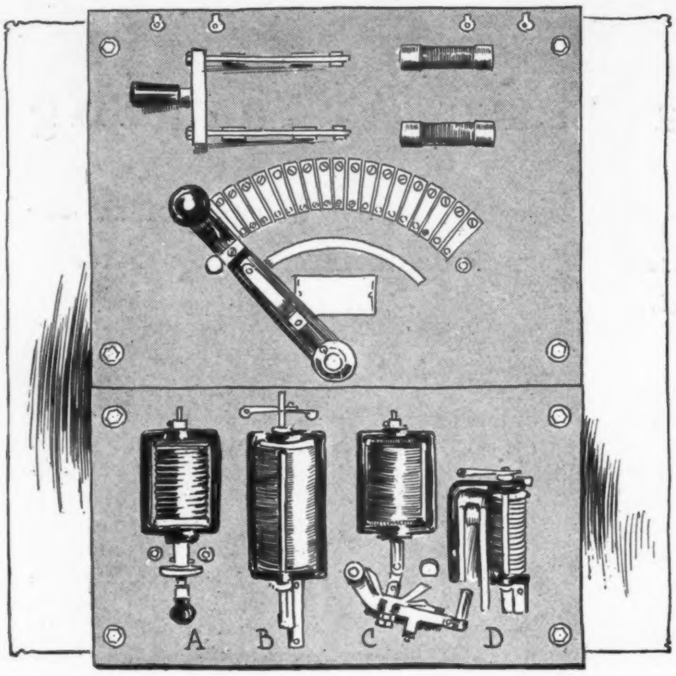


Fig. 3—Cutler-Hammer rheostat with automatic protective devices

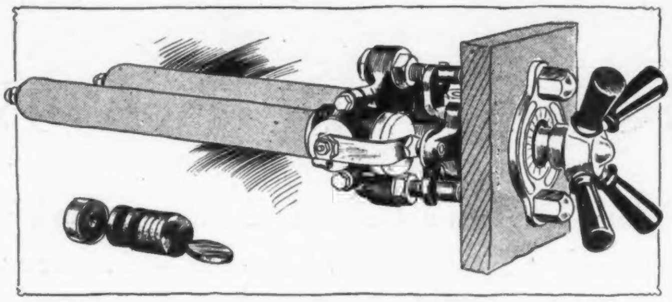


Fig. 4—Allen Bradley compression rheostat in which graphite discs form the resistance

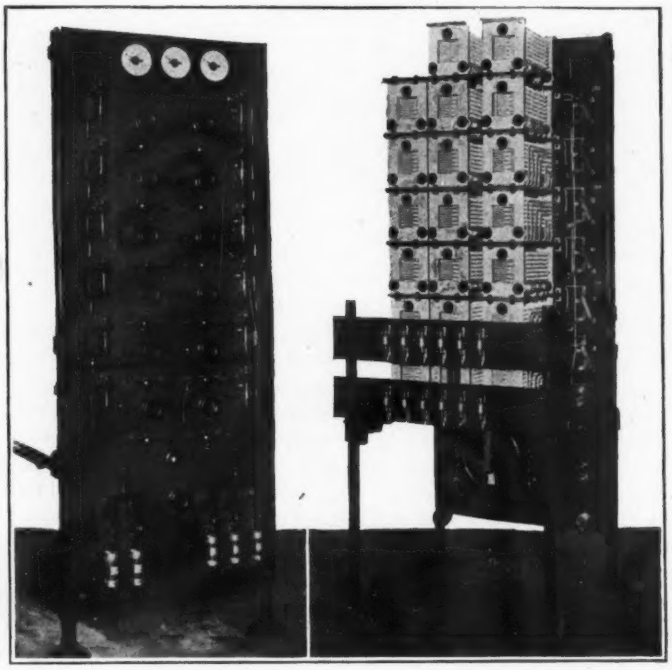


Fig. 5—Twelve-circuit rheostat set for a public garage, by the Westinghouse Electric Company

panels mounted together, one containing the main switch and the rheostat proper and the other the automatic protective devices. A is a low current cut-out which automatically opens the circuit if the current drops to a predetermined minimum. This prevents the battery from discharging into the line should the line voltage drop below that of the battery. B is a maximum voltage cut-out which opens the circuit when the battery voltage reaches the point at which the device is set to operate. C is a solenoid switch for opening or closing the main charging circuit. D is an overload circuit breaker to insure the battery against an excessive charging rate.

The operation of this type of battery-charging rheostat is as follows: After the battery and line connections have been made the operator first closes the knife switch and then moves the rheostat lever to the third contact segment, at the same time raising the plunger on the low-current cut-out A, thus energizing the solenoid switch C which closes the charging circuit and permits the current to flow through the resistance to the battery. As an additional protection the rheostat lever is provided with an electrical interlock which prevents the operator from closing the circuit to the battery except when the lever is in the off position, that is, with all resistance in circuit.

The same concern also builds these rheostats in multiple sets for public garage work. Fig. 9 shows a panel arranged with six rheostats, the two lower ones being discharge rheostats. This particular panel is for use with a motor-generator and the hand wheel and meter at the top are for the generator circuit. The two meters on the projection at the left, are for determining the rate of charge and the voltage of the batteries, any one of which can be switched on to the instruments when a reading is wanted. The instrument switch of each rheostat is situated directly to the right of the row of contacts, avoiding trouble and confusion in operation. When meter readings are taken the instrument switch does not break the charging circuit so that arcing at the blade is avoided.

The discharge rheostats at the base are a means of testing the electrical equipment of a car. For instance, in case of a vehicle not giving its rated average mileage and where some doubt exists as to whether the mechanical or the electrical equipment is at fault, the discharge rheostats can be used to determine whether the battery is capable of giving its rated ampere-hour capacity. If it does, then the fault lies elsewhere.

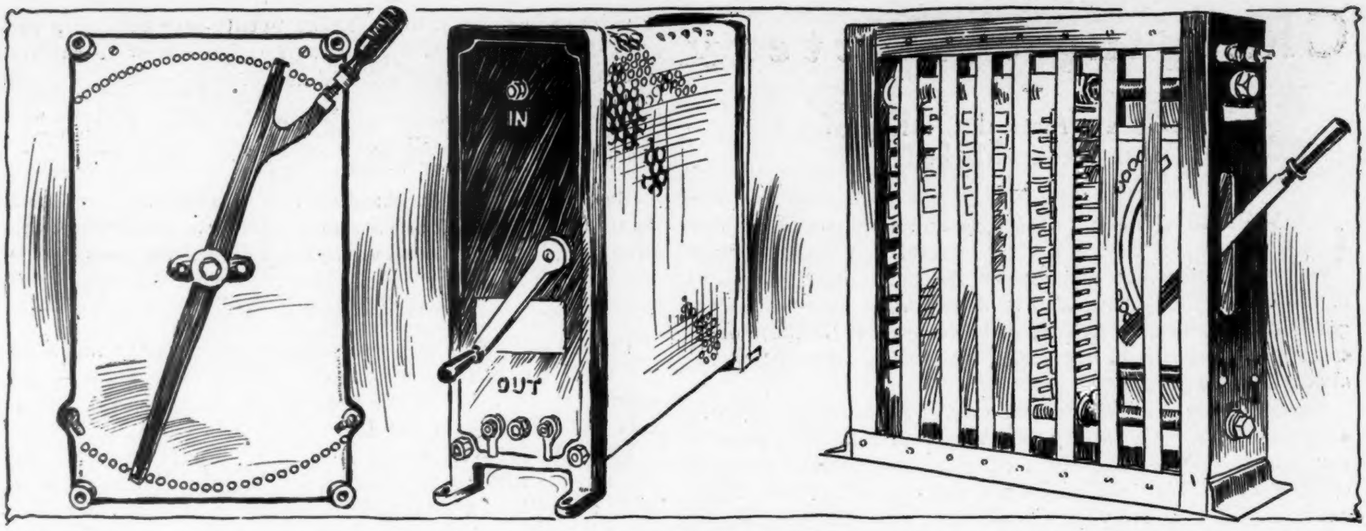
Front and rear views of a still larger charging set by the Westinghouse Electric Company, East Pittsburgh, Pa., are shown in Fig. 5. Grid resistances are used and the method of mounting these behind the panel is shown in the illustration. This board is equipped for twelve circuits, the rheostats being mounted behind the panel with the hand wheels only on the front.

The switches and regulator at the base of the panel are for controlling the motor-generator with which the charging set is designed to operate. The switchboard is equipped with a generator ammeter, a battery ammeter and a direct-current voltmeter; and for each charging equipment there is mounted alongside the rheostat wheel a single pole circuit breaker, a voltmeter receptacle for reading the individual voltage of each battery, and a single pole double-throw switch which throws the battery ammeter in and out of the individual circuit so that the charging current can be noted at any time.

The floor space required for this charging set is 36 inches by 30 inches.

Three types of rheostat units specially designed for banking in sets for large installations in public garages are shown in Figs. 6, 7 and 8. Each is self-contained and can, therefore, be used singly also, but they are made in a specially compact form suitable for arranging in a row, generally under the power switchboard.

Fig. 6 shows the Ward Leonard enameled plate type of rheostat. In this the resistance wire is embedded in enamel and cannot, therefore, suffer any depreciation by exposure to the elements. A flat switch arm provided with a projecting handle



Figs. 6, 7 and 8—Ward Leonard enameled plate resistance unit, and two types of grid resistance units by the General Electric Company and the Cutler-Hammer Manufacturing Company

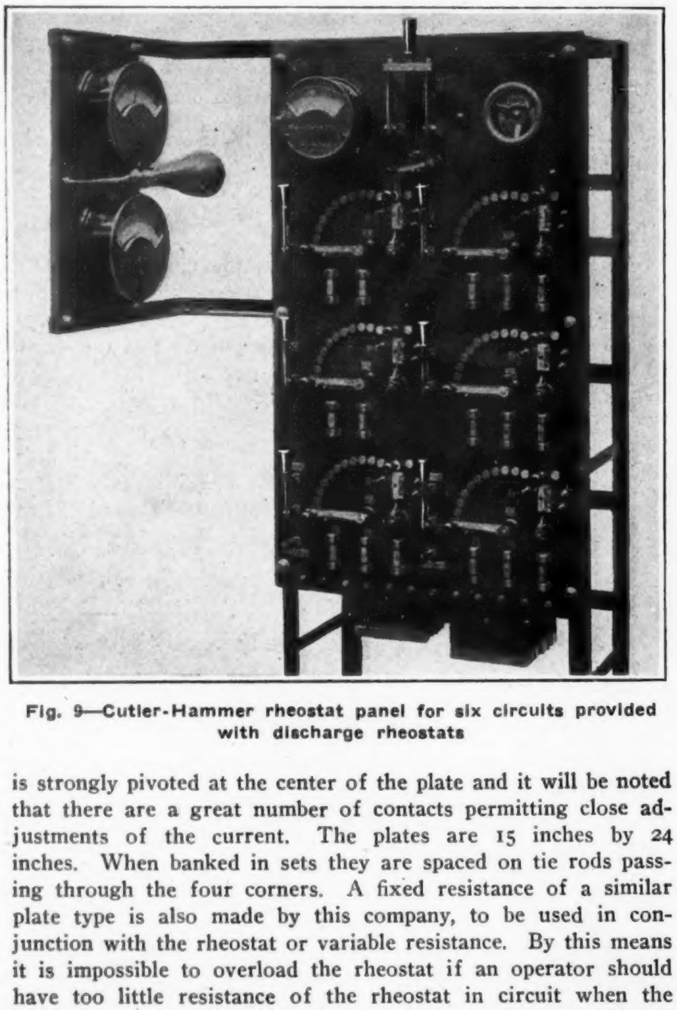


Fig. 9—Cutler-Hammer rheostat panel for six circuits provided with discharge rheostats

is strongly pivoted at the center of the plate and it will be noted that there are a great number of contacts permitting close adjustments of the current. The plates are 15 inches by 24 inches. When banked in sets they are spaced on tie rods passing through the four corners. A fixed resistance of a similar plate type is also made by this company, to be used in conjunction with the rheostat or variable resistance. By this means it is impossible to overload the rheostat if an operator should have too little resistance of the rheostat in circuit when the counter volts of the cells are low. The rheostat provides all the necessary variation.

The General Electric Company's CR211 rheostat, Fig. 7, is built in any capacity up to 90 amperes. It consists of two cast-iron end frames 16 inches high by 6 1-2 inches wide, connected by tie rods. These rods support the grid-type resistances in a vertical position and vary in length according to the capacity of the rheostat. The switch is mounted on a slate base immediately behind the front-end casting in such a manner that only the handle is exposed. Fifteen steps of resistances are provided. A perforated sheet metal cover, easily removable, extends from front to back and prevents accidental contact with live parts, without interfering with the ventilation.

Before charging, the handle should be moved up to its top position thereby inserting all the resistances into the circuit and preventing a large rush of current through the battery.

Fig. 8 shows one of the types of compact rheostats manufactured by the Cutler-Hammer Company. The resistances used are of the grid type and the rheostat panel is mounted inside with the handle projecting through a slot in the front plate. A standard height of 22 inches is adopted and the widths are 5, 7 or 10 inches according to capacity.

A rheostat which differs from all those previously described is the Allen Bradley compression rheostat, Fig. 4. Here the resistance is secured through the imperfect contact between the surfaces of prepared graphite disks piled in a column. This contact resistance varies with pressure, and the resistance changes are caused by subjecting the column to various degrees of pressure. The columns of disks are inclosed within an insulated steel tube, which is provided with suitable terminals and plungers for transmitting the pressure to the disks. Such inclosed columns constitute a complete resistance unit. The illustration shows a quantity of graphite disks such as is used and a complete rheostat of 1,000 watts capacity arranged for switchboard mounting. The graphite disks are well adapted for rheostatic service, as they will not crush or break, are not affected by any temperature that they have to encounter, cannot be fused, will not corrode and are not changed materially by years of service. These rheostats can be mounted directly on the back of the switchboard and take up very little space.

Harking Back a Decade

FROM THE AUTOMOBILE, January 3, 1903:

With New Year greetings to its readers *The Automobile and Motor Review* this week opens a new volume under the abbreviated title of THE AUTOMOBILE. The change in name will probably be welcomed by all. When THE AUTOMOBILE and the *Motor Review* were consolidated last June, it was thought best to incorporate both names in the title until the identity of the publication should have been thoroughly established. This, we believe, has now been done.—Editorial announcement.

Motorists in Chicago are up in arms over a proposed ordinance which, if passed, will compel them to carry an official number on the face of each lamp and also a number in 8-inch figures on the rear of the machine. A similar measure was passed recently by council, but was vetoed, and now it is bobbing up again with much apparent show of strength.

Charging a Battery

Being a Practical Outline of the Best Method

OWNERS of electric passenger and commercial vehicles are, when driving the car, careful to note the voltage and amperage readings on the measuring instruments of the vehicle; they have also read the varied instructions regarding care and maintenance of batteries; but **do these owners know what should happen to the battery when being recharged in the garage?**

To gain a clear concept of the modus operandi of charging a battery, consider a battery of twenty-four cells for a passenger vehicle. For convenience consider this battery an acid-type, lead-cell one (not an Edison cell), and that it is being charged from a 110-volt circuit direct-current supply, or should alternating current be the only available one then a rectifier would have to be used. For convenience throughout this article this current source of 110 volts will be known as the impressed voltage.

Example I—(These calculations are done with the number of cells in the battery and not the number of batteries.) The battery has twenty-four cells. A cell discharged to 1.8 volts is practically empty, or discharged as you may prefer to term it. With your battery so discharged the voltage available to run your vehicle is 1.8 volts × 24, a product of 43.2 volts. In equation this is

$$1.8 \text{ volts} \times 24 = 43.2 \text{ volts.}$$

This voltage is so low that you must recharge. The impressed voltage from the charging circuit is 110 and the battery voltage, which will buck or act counter to this impressed voltage during charging, is 43.2, so that your effective charging voltage is the difference between the impressed voltage and the counter voltage, or in equation

$$110 \text{ volts} - 43.2 \text{ volts} = 66.8 \text{ volts.}$$

Next consider the net result of this effective voltage on the battery: the internal resistance of the battery is so low as to be negligible. The equation is

$$\text{Current (amperes)} = \frac{\text{E (volts)}}{\text{Resistance (ohms)}}$$

From this equation it is evident that unless some form of resistance is inserted between the charging current and the battery the equivalent of a short circuit will result and such a large current or amperage will flow into the battery that it will be destroyed.

How much resistance is needed?

To determine this resistance assume that the data supplied you by the vehicle maker covering battery charging says, **"Maximum charging rate is 40 amperes."**

To charge at a constant maximum rate of 40 amperes we must have such a resistance as will not at any time permit more than 40 amperes current to enter the battery. Calculate as follows:

Impressed volts	110 volts
Counter volts	43.2 volts
Effective charging volts	66.8 volts
Maximum charging rate	40 amperes

With this information calculation is based on the equation

$$\text{Current} = \frac{\text{E (volts)}}{\text{R (resistance ohms)}}$$

$$\text{Or } 40 = \frac{66.8}{\text{R (in ohms)}} \qquad \text{or } R = \frac{66.8}{40}$$

$$\text{Or R} = 66.8 \div 40 = 1.67 \text{ ohms}$$

Example II—Consider that 40 amperes are entering the battery: instantly the voltage begins to rise and soon reaches 2 volts per cell, or a total for the twenty-four cells of 2 volts × 24 = 48 volts, which are counter volts. Now to calculate the requisite resistance proceed as follows:

Impressed voltage	110 volts
Counter voltage	48 volts
Net effective charging voltage	62 volts

But we still desire a charging rate of 40 amperes and must again use the equation (current = voltage ÷ resistance; or in other words resistance = voltage ÷ current) and we get

$$\text{Resistance (ohms)} = \frac{62}{40} = 1.55 \text{ ohms}$$

But we had 1.67 ohms in resistance, which is too much, and we must cut out the difference, namely (1.67 ohms — 1.55 ohms) .12 ohm, or, in other words, the resistance of the battery rheostat must be cut down this amount.

Example III—With this reduced resistance in circuit and 40 amperes flowing the battery voltage soon increases to 2.2 volts per cell, or a total voltage for the battery of (22 volts × 24) 52.8 volts, which of course is a counter or bucking voltage to further recharging. To determine the necessary resistance to allow 40 amperes to flow proceed as followed in Examples I and II, namely:

Impressed voltage	110.0 volts
Counter voltage	52.8 volts
Net effective charging voltage	57.2 volts

Using these figures in the equation (resistance = voltage ÷ current) we get

$$\text{Resistance (ohms)} = \frac{57.2}{40} = 1.43 \text{ ohms}$$

The present resistance, from Example II is 1.55 ohms, so that it is necessary to still further reduce this by (1.55 ohms — 1.43) .12 ohm.

Example IV—With this reduced resistance and the current flowing at 40 amperes the voltage per cell increases to 2.5 volts, giving a total for the battery of

$$2.5 \text{ volts} \times 24 = 60 \text{ volts (counter volts)}$$

To get the necessary resistance for this increased counter voltage we again proceed as in Examples I, II and III and get results as follows:

Impressed volts	110 volts
Counter volts	60 volts
Net effective charging voltage	50 volts

The necessary resistance is 50 divided by 40 or 1.25 ohms.

Deduction—From these four examples which show why a constantly reducing resistance is necessary in battery charging work, it is a natural deduction to infer the more steps in the reductions of resistance offered by the rheostat the better in making the reduction from 1.67 ohms to 1.25 ohms. **For charging a twenty-four cell battery at a 40-ampere rate practically all that is needed in a rheostat is to take care of a resistance reduction between 1.67 and 1.25 ohms in as many steps as possible, the more the better. Such a rheostat should be built to carry a 40-ampere current without overheating.**

Example V—Consider this case in which your battery has been fully charged to 2.5 volts per cell with 1.25 ohms resistance in the charging circuit; the car is taken out on the road and the next time it is charged the battery voltage is down to 1.8 volts per cell, giving a counter voltage for twenty-four cells of 43.2 volts or a net effective charging voltage of 66.8 volts, but your charging man was careless and only had 1.25 ohms in resistance instead of 1.67 ohms.

What would be the result?

Here it is: The current that will flow is 53.4 amperes instead of 40, the maximum charging rate of your battery, and with this current flowing unless the rheostat is designed for such it will overheat and burn out. This 53.4 amperes is ob-

tained as follows: Current flowing = voltage ÷ resistance, which is 66.8 ÷ 1.25 = 53.4. This example teaches the first rule of good practice in battery charging, to wit: **"Always insert all of the resistance of the charging rheostat before closing the switch to begin charging the battery, or else the battery will be charged at too high a rate and the rheostat overloaded."**

This example demonstrates that unless a single-step resistance is used, permitting of not more than 40 amperes to pass at any time, some indicating instrument, such as ammeter or current indicator must be used. By watching such instrument the current is seen to be automatically cut below the 40-ampere rate, at which time the rheostat lever must be moved to cut out resistance until the meter reading shows 40 amperes flowing.

Overload Circuit Breakers—As a precaution against short circuits overload circuit breakers are often used as a wise precaution. Fuses as a precaution against overload are necessary, being required by law, but they are slow to act and are not always reliable. In our problem a circuit breaker set at 41 amperes is preferable and will give protection against short-circuits and the neglect mentioned.

For a given job of this kind the best rheostat at lowest cost is one designed for 40 amperes capacity throughout. It might be supposed that in a 40-ampere rheostat 1.25 ohms resistance should carry 53 amperes until an attendant notices his ammeter and corrects the resistance to be such that 40 amperes will pass. It must be borne in mind that the heat varies as the square of the amperage and that the overload is 13 amperes. But in heat it is $13^2 \times 1.25$ (the resistance), or 211 watts, which you note is a high figure. It actually is only 33 per cent. increase in amperes, but 75 per cent. increase in watts, which is heat.

However, it is often desired that instead of charging at the maximum 40-ampere rate for a short time the battery be charged at a low rate for a long time. For example, we want to set a rheostat for all-night charging and start with, say, 10 amperes, and as the counter volts of the battery increase allow the charging rate to be automatically reduced. It is then necessary to have such a resistance that the counter voltage in the battery rises to the value given in the following table:

Impressed volts	110 volts
Counter volts	43.2 volts
Net effective volts	66.8 volts

To allow 10 amperes to pass, then, 6.68 ohms resistance is required in the rheostat (66.8 ÷ 10 = 6.68). The rheostat is then designed to have a total of 6.68 ohms resistance, and of this 1.67 ohms must have 40 ampere capacity and the rest have a tapered capacity of from 40 down to 10 amperes of charging current.

Automatic Underload Circuit Breakers—You may here ask the question: Is it possible to leave a battery on charge and have it automatically become disconnected from the circuit when the battery is fully charged? Yes, this can be arranged by having an automatic underload ampere circuit-breaker in the circuit. Calculate as follows:

Impressed volts	110 volts
Counter volts at beginning of charge	43.2 volts
Net effective volts	66.8 volts

and 10 amperes are to pass—then 6.68 ohms resistance is in circuit. But the counter volts increase to be 2.5 volts × 24 = 60 volts and the net effective volts are reduced to 50. Then with 6.68 ohms resistance in current 7.4 amperes will pass (50 ÷ 6.68 = 7.4). Then a circuit-breaker set to automatically open the circut when the current is automatically reduced to 7.5 amperes will disconnect the battery and stop the charge.

Now consider that you have two cars—to be extreme I will say a pleasure car twenty-four cells, 40-ampere maximum rate, and a truck of forty cells, 60-ampere charging rate. We have the figures in the twenty-four-cell car. The figures on the forty-cell, 60-ampere maximum charging rate are:

Impressed volts	110 volts
Counter volts	72 volts
Net effective volts	28 volts

and allow 60 amperes to pass .466 ohms (28 ÷ 60 = .46) resistance is needed, which must be reduced to

Impressed volts	110 volts
Counter volts (2.5 per cell)	100 volts
Net effective volts	10 volts

Sixty amperes to pass requires .166 ohms resistance (10 ÷ 60 = .166).

Now let us assume that .16 ohms of this rheostat is in circuit, and the twenty-four-cell battery discharged is connected in circuit; then

Impressed volts	110 volts
Counter volts	43.2 volts
Net effective volts	66.8 volts

The resistance in circuit is .16 ohms; then 417 amperes (66.8 ÷ 16 = 417) will pass which would immediately tend to ruin the battery and burn out the rheostat. If the circuit is protected with a circuit-breaker, the breaker would operate and save the fuses. If no breaker were used, the fuses would blow out, but probably not in time to save the battery and rheostat from injury. Therefore **note that the breaker would have to be set for the truck at 60 amperes; yet the maximum allowable charging current for the pleasure car is 40 amperes, so the circuit-breaker is not a proper protection for it between these limits.**

The above figures show that if a battery rheostat is to be used with a fixed number of cells it can be made economically, also the battery can be charged properly without fear of injury, and it can even be set to charge and it will automatically stop its charge when full. The circuit can be properly protected against damage by automatic circuit-breakers. For proper charging an ammeter is necessary. The one on the car can be used and often is used.

Advice—**These figures show that when the same battery rheostat is to be used to charge two cars or more with different numbers of cells then a rheostat must be made of a great number of steps so that the resistance can be greatly reduced and increased and also that overload protection by fuses and circuit-breakers is not readily obtained, the only way to properly charge the battery and protect the battery and entire circuit from abuse or destruction being to have skilled workmen who will always insert all of the resistance of the rheostat in circuit before closing the switch and who will then watch the ammeter carefully and adjust the resistance of the rheostat closely and often for proper charging.**

The garageman who has cars carrying from twenty to forty cells per vehicle must install rheostats that will cover this range and have capacity from 60 down to 10 amperes. Such rheostats are very expensive compared to a single rheostat for a fixed number of cells; they must be protected against short-circuit and brains are needed to handle them.

With a proper knowledge of why the increased amperage will pass, perhaps some great care and attention in garages will cause proper charging and a greatly increased life of the batteries will result.

For Garagemen—Always insert all of the resistance of a charging rheostat before closing the switch.

Always watch your ammeter closely and maintain charging rates as recommended by the car manufacturer.

Occasionally trip and open the automatic overload and underload circuit-breaker to see that they are in proper operating condition.

Never charge a battery at too high a rate, even for a short time. Never overload a rheostat.—D. J. Burns, Ward Leonard Electric Company.

1913 Vehicle Batteries

Edison and Lead Batteries Continue with Few Alterations, But Developments Awaited for Near Future

Manufacturers Are Busy Improving the Electro-Chemical Qualities to Increase Life and Capacity of Product

BATTERIES constructed for the work of propelling electric vehicles have not experienced any radical development during the year just closed. Whatever improvements have been made have been in the nature of small changes which tend to strengthen the battery and to lengthen its life. A great deal of chemical experimentation has been going on, as it always is, in this branch of electrical work, but few mechanical changes have been made. In this respect more than one step forward is expected to be taken by several companies during 1913.

One of the principal problems of the battery field is the guarantee situation. No settled position has been adopted by the host of makers, but several companies have made advances toward that goal. While some companies do not guarantee their product on the reasoning that once it leaves the hands of the makers and is subjected to the careless treatment of a driver, it is impossible for the maker to stand behind it, several concerns give a 1-year guarantee. The Ironclad Exide battery is even guaranteed for 2 years, or rather a period of 600 cycles during that time. In all probability this problem will be solved in the near future.

The Edison battery for vehicle-propulsion purposes is made in five sizes designated respectively A4, A6, A8, A10 and A12. The numeral in each designates the number of positive plates per cell, thus A6 has six positive plates and seven negative plates giving a total of 13 plates. There is always one more negative per cell than positive plates, thus A12 has twenty-five plates, twelve positive and thirteen negatives.

The Edison vehicle battery differs from all other storage batteries in that it is a non-acid type, in other words it is an alkali battery, but is more generally known as the nickel-iron battery because these elements are used as filling materials in the plates.

Another characteristic of the Edison battery is that the active material in the positive plates is filled into little perforated steel tubes so that with the vibration that the vehicle is subjected to when in operation this filling material cannot be shaken out and so the battery capacity is preserved, because whenever this active material is shaken out in any battery the battery capacity drops. The material in the negative plate is also put into little compartments, not tubes, but long, rectangular-shaped perforated pockets made of cold-rolled steel, nickel-plated, the same material as used in the tubes of the positive plate.

Look for a moment at each of these little tubes for a positive plate. Each tube is 4.25 inches long and approximately .375 inch in diameter. There are thirty of them in each plate. They are mounted vertically in two rows, one row across the top half of the plate and the other in the bottom half. These little tubes are made with the utmost accuracy. The tube is made from cold-rolled nickel-plated steel ribbon most carefully prepared for the job. It is then wound spirally by machinery, specially designed for this work, and when in tube form there are eight little steel rings slipped over the outside and spaced equidistantly, to add strength and to prevent any explosion.

Next comes the filling of this little tube, which is carried out with the utmost accuracy, for their must not be any variation, one must be filled identically with all others. In filling two substances are put in, one is pure metallic nickel in the thinnest flake form and the other is nickel hydroxide. These two are put in in layers, first nickel hydroxide and then the pure nickel flake. There are exactly 350 layers of each, 700 in all. This filling is done by specially designed automatic machinery. Each tube has exactly 700 layers. Tubes are regularly taken from each filling machine, cut in half longitudinally and examined with a microscope to see that this filling has been accurately done. When filled the tubes are carefully inspected, measured for length and the ends closed.

Next the negative plate: This is made up of long, rectangular-shaped pockets and each is filled with finely powdered iron oxide, which is put in with practically as great accuracy as to quantity as the filling in the little tubes of the positive plate. Twenty-four of these little pockets make up a negative plate.

In each cell of the battery the negative and positive plates are alternated, with narrowest strips of hard-rubber insulation between them. The jar into which the plates are placed is a cold-rolled steel one with all joints autogenously welded. The jar walls are corrugated to add strength. The jars or cells are in turn assembled in very light trays for convenience in battery handling.

The leading virtue of the Edison battery is its long life, due to the tube-and-pocket construction of the positive and negative plates which prevents falling out of active material because of vibration, and of heat in charging and discharging. The battery is also much lighter than the other types. The battery will stand very high charging rates and can be discharged at any rate to meet the service without injury. The tube-and-pocket construction permits of this. The battery is sold with a 4-year guarantee on cell capacity and a 1-year guarantee covering the defects in workmanship or material. When fully charged the voltage per cell is 1.85 and to get the required voltage for charging a battery it is necessary to multiply this by the number of cells in the battery. A twenty-four-cell battery requires 45 volts; a sixty-cell battery 111 volts.

Four Types of Exide Batteries

The Electric Storage Battery Company, Philadelphia, Pa., for 1913 offers four types of storage batteries for vehicle propulsion, namely, the Exide, Hycap Exide, Thin Exide and Ironclad Exide. Each type is furnished in various sizes, which depend on the numbers of plates used in each cell of the battery, the various models are classified under the heads MV and PV, according to the plate sizes. Taking up these four types in turn, the exide MV battery comes in eight sizes having seven, nine, eleven, thirteen, fifteen, seventeen, nineteen and twenty-one plates, respectively. No matter how many plates are used the voltage of each cell is the same only the amperage being subject to change, increasing with the total surface of the plates in the cell. The Exide MV sizes just enumerated have respective capacities of 84, 112, 140, 168, 196, 224, 252 and 280 ampere-hours. Exide PV comes in four sizes with five, seven, nine and eleven plates, respectively, the capacities of these batteries being 48, 72, 96 and 120 ampere-hours, respectively. The Exide type of battery is heavier than the Hycap and the Thin Exide types; it is more economical for trips of small mileage, especially if it is to be used on trucks and subjected to hard work. The Hycap Exide type has somewhat thinner plates than the Exide type, but like the latter comes in two plates sizes MV and PV. Nine sizes of MV cells are available, having nine, eleven, thirteen, fifteen, seventeen, nineteen, twenty-one, twenty-three and twenty-five plates, respectively, with capacities of 110, 138, 165, 193, 220, 248, 275, 303 and 330 ampere-hours. The PV cells come in three sizes with nine, eleven and thirteen plates, respectively, resulting in capacities of 93, 115 and 128 ampere-hours. The Thin Exides having, as its name implies, thinner plates than the two preceding types, is furnished in eleven MV sizes, which have from eleven to thirty-one plates, each type having two more plates than the preceding one. The capacities of these batteries vary from 130 to 390 ampere-hours.

The three Exide types just described are of conventional design in many respects. They have the staggered type of grid for both positive and negative plates, the former containing peroxide of lead in pasty form while the latter contain paste lead. To keep positive and negative plates properly spaced at all times separators of rubber and wood are used. The rubber is in form of a thin sheet perforated to permit of passage of the acid through it, while the wood plates are formed with projections on one side; these projections face the rubber sheets, one of which is in place on either side of each positive plate. Likewise, a wooden separator is arranged with one plain side at each side of every negative plate and has projections on the other side which hold the entire system properly spaced and insure also acid spaces adjacent to both sides of every plate. No provisions have been made to facilitate flushing of the jars as the plates rest on the high bridge under which there is plenty of space for dead material which has dropped from the plates.

The Ironclad Exide type of battery is, in a way, the leader of the line, being adaptable for all sorts of service and designed for a much longer life. It comes in eight MV sizes, having from seven to twenty-one plates with battery capacities of 94, 126, 158, 190, 220, 252, 283 and 316 ampere-hours, respectively. The Ironclad type differs from all others by the construction of the positive plates which are not built up on a staggered frame but are formed of a number of hard-rubber tubes with small passage for the acid in them; in these hard-rubber tubes the oxide paste is carried around a conductive core which is connected to a transverse contact rod in the top of the plate. All four sides of the plates are fitted with rubber strips vulcanized on to them to shield the hard-rubber tubes from shocks by too rough handling. The hard-rubber serves as insulator for the positive plates so that the rubber sheets used in the other types are not necessary in the Ironclad type; furthermore, a thinner wooden separator is used which affords more ample acid space between each two plates. Another improvement which has been incorporated in this type is the use of a special wood for these separators, which is called Gulf wood and placed in the jars with its grain arranged horizontally. Experiments of the Exide company show this to prolong the life of the separators.

The Geiszler Bros. Storage Battery Company, New York City, manufactures vehicle batteries to order although it has no standard product in this line. The vehicle batteries are of the non-sulphating type, and in construction very similar to the other Geiszler batteries, the sizes being determined by the specific requirements of the user of the battery.

U. S. L. Batteries Have Thick Plates

The United States Light & Heating Company of Niagara Falls, N. Y., and New York City make three principal classes of vehicle batteries distinguished by the thicknesses of their plates as WB, WBH and WBT. WB is the heaviest plate, being .210-inch thick, while WBH is of medium thickness, and WBT the thin type. In each case positive and negative plates are of the same thickness. The types CB and CBH of this company are not used extensively and we therefore will limit our attention to the three types first mentioned. The type WB comes in eight sizes, having from seven to twenty-one plates with an ampere-hour capacity from 84 to 280 if charges at a four-hour rate from 90 to 300 at a 5-hour rate, or from 97 to 324 at a 6-hour rate, likewise the capacity for work depends on the time in which the batteries are discharged. The WBH batteries include eight sizes, having from eleven to twenty-five plates, and ampere-hour capacities from 140 to 336 at a 4-hour charging rate, from 150 to 360 at a 5-hour rate and from 162 to 388 at a 6-hour rate. As to the WBT type, there are eleven sizes of cells having from eleven to thirty-one plates and capacities ranging from 125 to 375 ampere-hours at a 4-hour rate of charging, from 135 to 405 at a 5-hour rate and from 144 to 435 at a 6-hour rate. As in the case of the Exide batteries the heaviest types of plates should be used where a vehicle is designed to travel a small number of miles per day, but do so at a very low cost, whereas high mileage with somewhat higher cost per mile may be obtained from the thinner plate types. The plate frames are in all cases of the staggered type, being pressed of lead to which a small trace of antimony has been added to increase its hardness and strength. The positive plate is filled with peroxide of lead and the negative with paste lead which is substantially the general practice with lead batteries. Wooden and rubber-veneer separators are used to keep the positive and negative plates from contacting with one another and to afford definite spaces for the acid between the plates. The company furnishes the batteries with either high or low bridges on which the plates rest, but it advocates the use of a high bridge so as to prevent short circuiting of the cells by an accumulation of dead matter between the bottom parts of the cells. The covers are sealed and a soft rubber vent affords a means for flushing the battery and refilling the water evaporated and decomposed in service. If a sufficiently high bridge is used flushing of the battery does not become necessary at any time. No specific improvements have been announced so far.

Five types of vehicle-propulsion batteries are the offering of the Gould Storage Battery Company, New York City, for 1913. Two of these types use thin plates and are designed for high capacity, whereas two others are styled medium-capacity types and use thick plates; the fifth type is named semi-high capacity. Type TH or the high-capacity, thin-plate type comes in eleven sizes, fitted with 9 to 29 plates, respectively, and ranging in capacity from 110 to 385 ampere-hours. If discharged in the course of 5.5 hours, the amperage obtained from these batteries varies from 20 to 70 amperes. The other high-capacity, thin-plate type has plates considerably smaller than the type TH. This small-plate type is named NH and comes in five sizes, from seven to fifteen plates, and capacities from 68 to 158 ampere-hours. The amperage varies from 13.5 to 31.5 for a 5-hour discharge rate. The larger medium-capacity, thick-plate type is known as RP and is furnished in eight sizes having from 7 to 21 plates and capacities ranging from 84 to 280 ampere-hours. This battery is designed for 4-hour charge and discharge the current obtainable varying from 21 to 70 amperes for the eight sizes of battery. The fourth type of battery is a smaller medium-capacity, thick-plate design and comes in four sizes having from 5 to 11 plates. The ampere-hour capacities of these sizes are 48, 72, 96 and 120, and if discharged in 4 hours these batteries furnish currents of 12, 18, 24 and 30 amperes. The last type MC is referred to as a semi-high capacity design and its nine models have from 9 to 25 plates with total capacities of the batteries from 112 to 336 amperes. This type is designed for a discharge rate of 5 hours and a current obtained under this condition ranges from 22.4 to 67.2 amperes. The positive as well as negative plates in all Gould types are of a staggered design and are spaced by wooden separators which bear against the faces of the negative plates and by perforated hard-rubber sheets contacting with both sides of the positive plates. The wooden separators are formed with projections as in the case of the foregoing makes of batteries and for the same purpose. The jar is of hard rubber and fitted with a soft rubber vent permitting hydrogen and oxygen which are formed during the operation of the battery to escape.

Willard Plates Differ in Thickness

The 1913 products of the Willard Storage Battery Company, Cleveland, O., include two sizes of plates, each of which is made in three degrees of thickness: J and K correspond in thickness to the Exide plate, L and M to the Hycap Exide and N and O to the Thin Exide type, the second plate mentioned being the larger size. The capacities vary from 120 to 250 ampere-hours. Staggered grids with more but thinner bars than found in other batteries are used, the active material is practically the same as in other makes and the separator scheme roughly identical with others. Bass wood cellulose and perforated rubber form the separating materials. Standard high bridges are used to prevent short-circuiting.

Petit Shows How Considerable Aid in the Designing of a Water-Cooling System May Be Obtained from a Theoretical Study of the Temperatures Involved—An Interesting Motor Booster—Advance View of Panhard New Carbureter

THEORY of the Water-Cooling of Gasoline Motors.—With a view to the problems which arise for designers when motors must be built just large enough for the work required of them (when the motors, in other words, are to be operated a large part of the time up to their full capacity while the vehicle runs slowly), Henri Petit presents the theoretical considerations which should be guiding in the planning of the water-cooling system for such motors, the results in each case being subject to correction, of course, as practical experiments and testing may dictate. [An account of a searching practical testing method was given in THE AUTOMOBILE of last week. The practical value of the following exposition lies perhaps mainly in the fact that it compels the reader to reason exhaustively and with precision on a subject which is usually treated experimentally or imitatively only. The author shows at least that all factors involved are within reach through the science of physics. A still more substantial value can probably be realized by working it over in English terms and accompanied by an analysis of Fourier's and Ser's formulas or equivalents for the same. It might perhaps be found that the factor lambda (λ) should represent something more than the mere linear speed of the water circulation, if not exactly the pump capacity.—ED.]

According to Fourier's theory of conductivity, the heat transmitted through the cylinder wall is determined by the equation:

$$(1) \qquad q_1 = Ks\frac{V_0 - V_1}{e}$$

in which q_1 is the heat transmitted; V_0 the temperature of the internal wall of the cylinder; V_1 the temperature of the external wall; V_2 the temperature of the water; s the area of the internal wall; e the thickness of the wall; and K the coefficient of absolute conductivity of the material of the cylinder. The units chosen are centimeter, second and degree C. For iron at a temperature of 100 deg. C. the value of K was found by Forbes to be 0.156 which may be abbreviated to 0.15, this giving a margin of safety for the assumption that the coefficient is the same for cast iron.

The heat transmitted to the water from the wall in contact with the water must be:

$$(2) \qquad q_2 = \lambda s_1 (V_1 - V_2)$$

in which lambda (λ) is a coefficient varying with the speed of the water circulation, and s_1 the area of the external cylinder wall (inside of the jacket).

But as all the heat, q_1, transmitted through the wall is evidently transmitted to the water, q_1 must equal q_2, and we have:

$$V_0 - V_1 = \frac{eq_1}{Ks} \text{ and } V_1 - V_2 = \frac{q_1}{\lambda s_1}$$

By addition of these equations one gets:

$$V_0 - V_2 = q_1\left(\frac{e}{Ks} + \frac{1}{\lambda s_1}\right)$$

and as s_1 can be taken as equal to s without appreciable error, this can be simplified and written:

$$(3) \qquad V_0 - V_2 = \frac{q_1}{s}\left(\frac{e}{K} + \frac{1}{\lambda}\right)$$

On the other hand, the speed of the water in the jacket is given by the formula

$$V = \frac{n}{S}$$

in which V is the speed in centimeters per second; n the delivery of the pump in cubic centimeters per second, and S the cross-sectional area of the water jacket. The water which is carried into the jacket at the temperature tau-$_o$ (τ_o) and is raised to the temperature of tau-$_1$ (τ_1) while there, takes away in one second a number of calories equal to

$$n(\tau_1 - \tau_2).$$

On the other hand it is also known that the number of calories ceded to the water is expressed in the formula:

$$(4) \qquad q_1 = \frac{s(V_0 - V_2)}{\frac{e}{K} + \frac{1}{\lambda}},$$

which is derived from equation (3). The temperature of the water in the jacket may be taken as the mean between the temperatures at entering and at leaving the jacket; hence

$$V_2 = \frac{\tau_1 + \tau_0}{2}$$

And from this we get the equation which expresses a condition which can be maintained constant:

$$(5) \qquad n(\tau_1 - \tau_0) = \frac{s\left(V_0 - \frac{\tau_1 + \tau_0}{2}\right)}{\frac{e}{K} + \frac{1}{\lambda}}$$

This equation cannot be solved with reference to the value of n, because λ and τ_0 are both functions of n, (τ_0 depending on the speed of the water in the radiator), but n can be determined from it by a series of approximations, trial values being put into the equation—which is considerably more time-saving and less costly than building trial values into the cooling system.

The cooling in the radiator.—Having established a condition under which the water when it has entered at the temperature of τ_0 always departs from the jacket at the temperature of τ_1 and enters again at τ_0, we know that this water while it is away from the jacket gives up $n(\tau_1 - \tau_0)$ calories, the same number which it absorbed from the cylinders.

Let sigma (Σ) be the ventilated surface of the radiator and v the speed of the air in passing through the radiator, and let theta-$_o$ (Θ_o) and theta-$_1$ (Θ_1) be the temperatures of the air entering and of that leaving the radiator. According to the tests of Mr. Ser the heat Q given up by the hot water to the air should have the value:

$$Q = \Sigma f\sqrt{v}\,(\tau_m - \Theta_m)$$

in which τ_m is taken as the mean of τ_1 and τ_o and Θ_m as the mean of Θ_1 and Θ_o. In this equation f is a coefficient which according to Ser should take the value of 0.19403 when v varies from 67 centimeters to 461 centimeters and when $(\tau_m - \Theta_m)$ varies from 65 deg. C. to 75 deg. C. If $(\tau_m - \Theta_m)$ varies from 35 deg. C. to 45 deg. C., f equals 0.17678.

In practice τ_m is usually 70 deg. C. and Θ_m is 20 deg. C., and we can therefore take the value of f as about 0.1800.

Ser's formula can then be written:

$$(6) \qquad n(\tau_1 - \tau_0) = 0.18\sqrt{v} \times (\tau_m - \Theta_m)\,\Sigma,$$

but according to Ser's data this equation is justified only if the temperature of the air is raised about 50 deg. C in passing through the radiator. A condition of this nature should be effected. To this end, let omega (ω) be the cross-section area of the air passage in the radiator. There will then pass in each second $v\omega$ cubic centimeters of air and this air will weigh:

$$\frac{v\,\omega\,a}{1 + \dfrac{\Theta_0}{273}}$$

By ignoring the fraction Θ_0 divided by 273, we have then for the heat absorbed in the air: $v\omega a \times \gamma(\Theta_1 - \Theta_0)$, in which gamma ($\gamma$) is the specific heat of the air, or 0.237, and by accepting alpha (a) as equalling 1.293, as the textbooks have it, the quantity of heat absorbed can be written: $0.342 \times v\omega\,(\Theta_1 - \Theta_0)$ and from this we get:

$$(7) \qquad n(\tau_1 - \tau_0) = 0.342\,v\omega\,(\Theta_1 - \Theta_0).$$

And by combining with equation (5):

$$(8) \qquad 0.342\,v\omega\,(\Theta_1 - \Theta_0) = s\,\frac{\left(V_0 - \dfrac{\tau_1 + \tau_0}{2}\right)}{\dfrac{e}{K} + \dfrac{1}{\lambda}}$$

while also keeping in mind the relation derived from equations (6) and (7):

$$f\,\Sigma\,(\tau_m - \Theta_m) = 0.342\sqrt{v} \times \omega\,(\Theta_1 - \Theta_0)$$

which can now be put in the form:

$$\frac{\Sigma}{\omega} = \frac{0.342\sqrt{v}\,(\Theta_1 - \Theta_0)}{f\left(\tau_m - \dfrac{\Theta_1 + \Theta_0}{2}\right)}$$

This equation permits us to follow the variations of $(\Theta_1 - \Theta_0)$ when $(\Sigma \div \omega)$ varies.

Equation (8) shows plainly that the cooling takes place solely by virtue of the amount of air brought into contact with the radiator surface. The quantity of water, which is the intermediary agent, enters in the formula only by the variable λ which expresses its speed.

By testing the formulas in practice the following values for λ according to variations in the speed of the water are found:

Speed of the Water in Meters per Second	Value of λ	Speed of the Water in Meters per Second	Value of λ
0.10	4.2	0.60	10.
0.15	5.8	0.70	10.7
0.20	7.	0.80	11.25
0.30	8.2	0.90	12.
0.40	8.8	1.00	12.6
0.50	9.4	1.10	13.3

Cooling by the Thermo-Siphon System—Circulation of the cooling-water is frequently of late, in small motors, effected by utilizing the difference in the density of hot and cold water on the plan illustrated in Fig. 1. The reservoir A is in communication on one side with the motor M and on the other with the radiator R. A collector G is placed below the latter. It is necessary to have the reservoir at a higher level than the motor. The water heated by the cylinder walls rises into the reservoir, and the cooled water in the collector is driven by the pressure upon it into the lower portions of the water jackets.

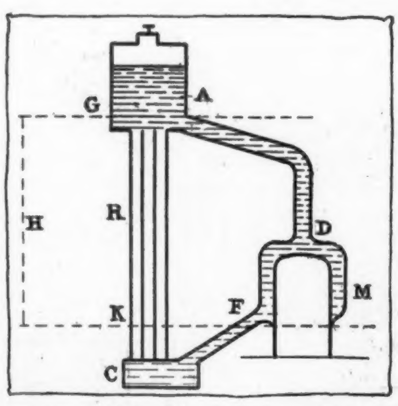


Fig. 1—Diagram of thermo-siphon system of water-cooling

Let H be the difference in levels between the reservoir and the entrances to the jackets. It may now be supposed that th water in the channel FDG is at one temperature t and that the rest of it, filling the portion GRKCF, is at the temperature t'.

The pressure per unit of surface which pushes the fluid in its direction of motion is equal to H $(\omega_t' - \omega_t)$; ω_t and ω_t' being the specific gravity of the water at the two different temperatures.

Utilizing the formula for the expansion of water volumes V_0 and V_1, according to which

$$V_1 - V_0 = (at + bt^2 + ct^3)\,V_0$$

a value for ω_t is obtained by determining V_0 divided by V_t, giving

$$\omega_t = \frac{1}{1 + at + bt^2 + ct^3}$$

in which the coefficients a, b and c have different values according to the limits between which the temperature varies.

Let it be supposed that the temperature in the collector C is lower than 50 deg. and that in the jacket it is close to 100 deg.

The established coefficients give then:

$$\omega_t = \frac{1}{1 + 0.000004788t + 0.00000546 28t^2 + 0.0000000175t^3}$$

and

$$\omega_t = \frac{1}{1 - 0.000063230t + 0.0000077385t^2 - 0.000000036375t^3}$$

By inserting the values of 90 degrees for t and 40 degrees for t', these equations give:

$$\omega_t = \frac{1}{1 + 9 \times 0.00004788 + 81 \times 0.00054628 + 729 \times 0.0000175}$$

and

$$\omega_t' = \frac{1}{1 - 4 \times 0.0006322 + 16 \times 0.00077385 - 64 \times 0.000036375}$$

and, by finishing the figuring:

$$\omega_t' - \omega_t = 0.023$$

For a height of one-half meter for H the pressure should thus be only 1.15 grams per square centimeter, equal to a head of a little more than one centimeter of water.

This pressure, it will be noticed, is very small and is in all cases proportionate to the height of H.

It is therefore necessary, if it is desired to cool by the thermo-siphon system, (1) to raise the reservoir and the radiator and to lower the motor, in order to make H as large as possible, (2) to make the water pipes of very large section, in order to maintain a sufficient speed in the water jacket and (3) to avoid all sudden turns in the piping as well as all contractions which would cause harmful friction in the system.

[Of which the moral is that the thermo-siphon system is not well adapted for large long-stroke motors.—Ed.]—From *La Technique Automobile,* August 15.

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COMPRESSED-AIR Motor Booster—By trials over two kilometers of a road near Paris it was demonstrated last summer that a car which could be driven at a speed of 39.6 kilometers per hour when equipped with an ordinary carbureter could reach a speed of 54 kilometers when equipped with the *Décupli* which is a device comprising a double carbureter, an air pump and a mechanism by which the air pump can be engaged and disengaged. When the air pump is working, it sends compressed air through the closed carbureter at such a rate that the motor cylinders filled up with air and fuel vapor at about twice as high a pressure as ordinarily. The fuel under this condition is fed from a special nozzle and, to make it flow, the float chamber is connected with the compressed air in the carbureter instead of with the atmosphere.

The two-cylinder air pump mechanism is operated by pulleys and belt, the power being taken from the transmission shaft

of the vehicle, and the air is piped to the carbureter. This part presents no features of unusual interest, though the use of the same pump for the inflation of tires and the starting of the motor (by adding an air tank) is suggested. A section through the carbureter portion of the *Décupli* is shown in Fig. 2, and the float chamber may be imagined as located adjacently to the space between the two nozzles A and B. In this illustration G is the throttle which is connected by rod *g* with the air valve F in such manner that when G is closed F is open and supplies the air for running slowly and for starting, but when the compressed air mechanism is in action F affords an exit for the surplus air which enters at H, this arrangement admitting of operating the throttle even without first disengaging the booster device. L is the induction pipe joint, and A the nozzle for normal operation. B is the nozzle for operation with the booster in action; it is held closed by means of piston *b* until the air pressure becomes sufficient to raise this piston against the resistance of the spring which holds it against the nozzle. C is a valve letting air in at J unless it is held closed by a higher interior pressure. D is a similar valve fitted with a stronger spring and admitting additional air at K when the motor is running at high speed, but is also inoperative when the booster device is at work. E is a safety valve limiting the air pressure to the maximum desired.

The road tests of the device were timed by the official timers of the Automobile Club of France, and the laboratory trials were supervised at the Institute for Arts and Trades. A fifty per cent. increase of the motor power was uniformly demonstrated. The device is looked upon as a "reserve horse" to be used in emergencies in connection with small motors of otherwise insufficient power and has also been mentioned as a means for enabling vehicles to compete in racing events with other vehicles equipped with motors of larger cylinder volume. It is not stated whether it has been used for experimenting with other fuels than gasoline, for which purpose it apparently might be adapted. The inventors are Crouan and Huillier, 15 *bis* Rue Saint Didier, Paris.—From *Omnia*, Dec. 7.

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CARBURETER in New 10-HP. Panhard.—The resemblance of the carbureter in the new small Panhard cars with poppet valve motor to the Zenith carbureter is only superficial. When the throttle, R in the accompanying illustration, Fig. 2, is closed or approximately closed the groove Y in the wall of the throttle chamber is laid open and allows the suction from the motor to act upon the secondary jet MJ instead of the main jet G, but there is established a play of interaction between these two jets which is not found in other carbureters. When the throttle is opened a little and the suction begins to act on the main jet G the gasoline feed to the secondary jet is thereby cut down, and when the opening up of the throttle continues the secondary jet runs dry and begins to feed air backwards into the interior of the main jet, acting as auxiliary air duct. The air, managed in this way, assists in atomizing the spray while also reducing the richness of the mixture. The proportions of the mixture are regulated by means of a second auxiliary jet F at the base of the main jet. It is by means of F that the gasoline, which enters from the float chamber through the channel U, is fed downward to jet MJ when the latter is in action. V is the screw for adjusting the channel YM to the slow-speed jet M. E is the air intake.—From *Omnia*, December 14.

[The description does not reveal the exact manner in which the jet F operates or how the air is introduced which finds its way from jet MJ to the interior of jet G—unless it be taken directly from the induction channel. Neither does the illustration give any clue on this point, unless the lateral openings shown at T in MJ may be taken as an indication in this respect. The idea of mixing air with the fuel in the interior of the jet has been tried in other carbureters and seems to be gaining ground.—Ed.]

—

INVENTOR of Gas-Accumulator Honored.—The Nobel Prize for physics was awarded this year to Gustav Dalen, a practical Swedish engineer, who unfortunately lost his eyesight by a gas explosion in September, 1911. He invented modifications in gas-accumulator systems which have resulted in the development of the acetylene gas tanks used as a light-source in automobiles, and also for buoys and lighthouses which give intermittent flashes during the night and in murky or foggy weather. These are in use along the entire coast of South America and along the Panama Canal. His acetylene gas-accumulator consists of a steel receiver filled with a porous substance prepared with asbestos and soaked with acetone. This forms a mass of capillary cells which prevent the acetylene molecules from being pressed hard together and thereby obviate an otherwise possible explosion. The Dalen gas-accumulator can absorb gas to the extent of a hundred times its own volume.

When these tanks are used for buoys or lighthouses they are equipped with a sun-valve, also invented by Dalen, which shuts off the gas when the sun is shining and turns it on and lights it when darkness sets in for any cause. These buoys therefore require no attendance except for renewal of the gas supply. The sun-valve operates by the unequal expansion of two bars of different metals, one black, so as to heat up in the sunshine, and the other bright.—From *Engineering*, Dec. 6.

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Strength of River Joints.—An article on tests of nickel-steel riveted joints, based upon tests made with rivets and plates of different alloys—as well as plain carbon steel—at the University of Illinois, is found in *Engineering* (London) of Sept. 6.

Fig. 2—The Décupli compressed-air motor booster

Fig. 3—New carbureter in 10-hp Panhard car

The Engineers' Forum

A Theory of Carburetion

Forrest A. Heath Considers Complete Breaking Up of Fuel Particles Into Small Globules Most Important

NEW YORK CITY—Editor THE AUTOMOBILE—The interest you are stirring up in the carburetion problem is very valuable. There is no department of hydrocarbon engineering so little understood and so greatly in need of illumination.

What the engineer wants is a simple mechanism that will furnish the required amounts of fuel and air, carburet the air with fuel, and supply the resulting mixture in varying volume **without variation as to its combustibility.**

A lump of coal burns slowly until consumed. Gasoline burns in the same manner. The lump of coal, broken into small pieces, burns more rapidly. The gasoline, separated into drops, acts similarly. Coal, converted into powder and scattered through the air, will exhibit the explosive characteristics of gasoline vapor. Gasoline vapor is composed of minute particles scattered through the air. In each case the fuel, when converted from the lump into the powder, changes its state of aggregation. The change makes it possible for more of the oxygen of the air to come in contact with more of the carbon and hydrogen of the fuel.

The axiom that the actual power of a hydrocarbon motor depends upon the speed with which the fuel burns, means that the more rapid the expansion of the gases, the greater the duration and extent of the pressure on the piston.

In the operation of a motor the gasoline is drawn from the carbureter float chamber through a nozzle, where it comes in contact with a current of air which carries it to the combustion chamber of the cylinder. The greater the rush from the fuel nozzle, the more thorough the breaking and scattering of the fuel.

Each suction impulse starts a spurt of spray from the nozzle. Instead of a column of homogeneous mist there is a column of air carrying intermittent jets of fuel, and at high piston speeds a stream of gasoline spray. The column of air, with its entrained spurts of gasoline streaking through it in parabolic curves, is drawn first to one cylinder, then to another. The inlet valves are opening and closing in accordance with the speed of the motor, but without regard to the time of arrival of the fuel spurts. Except at very high piston speeds the mixture distributed to the cylinders is of varying density.

Fig. 1 shows a jet of fuel from a carbureter nozzle under low vacuum. Fig. 2 shows the changed condition of the fuel under high vacuum.

Fig. 3 is a magnified representation of a fuel particle from Fig. 1. Fig. 4 represents the particle broken up into eight smaller globules, as in Fig. 2. While the mass is the same in both cases, the surface area exposed to the heat of the air for evaporation, or to the oxygen of the air for combustion, is twice as great in Fig. 4 as in Fig. 3. Evaporation may be said to be the result of attraction exerted by the heat of the air upon the surface of the fuel globules, drawing minute particles away from the mass. A B and A' B' represent equal sections of fuel surface, as shown by X and Y, upon which equal attraction is exerted. But molecular attraction within the mass of the Fig. 3 globule is twice as great as that of the Fig. 4 globule, as shown by the cone surface areas A O B and A' O' B'. Hence, the 100 per cent. advantage in evaporation surface possessed by the Fig. 4 globule is augmented by 50 per cent. less resistance to evaporation. Therefore, in the condition represented by Fig. 4 only one-half as much fuel is required for combustion as in Fig. 3, the amount of air being constant. And, moreover, as the waste is greater in the case of Fig. 3, because of the greater quantity of carbon coking out under the heat of compression, the saving of 50 per cent. in fuel is accompanied by an increase in power.

With the carbureter adjusted properly for speed, the motor will not pull a full load satisfactorily when running slowly. In the latter case the fuel is not only less combustible, as shown above, but the air is carbureted in splotches. Therefore the walls of the carbureter, intake pipe and manifold must be drenched with an excess of fuel to provide additional vapor to fill up the uncarbureted zones.

What is required is **a thorough breaking up of the fuel and an intimate mixing with the air and a means of maintaining constancy in this operation under varying vacua.**—FORREST A. HEATH, The Aristos Company.

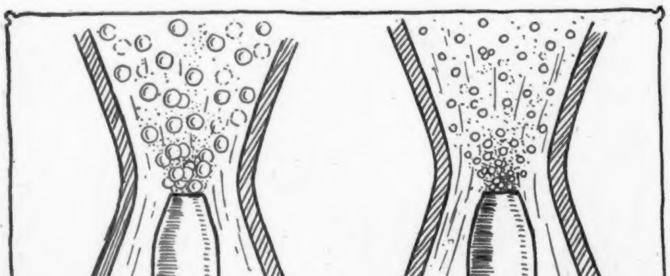

Fig. 1—Appearance of fuel under low vacuum
Fig. 2—Condition of fuel under high vacuum

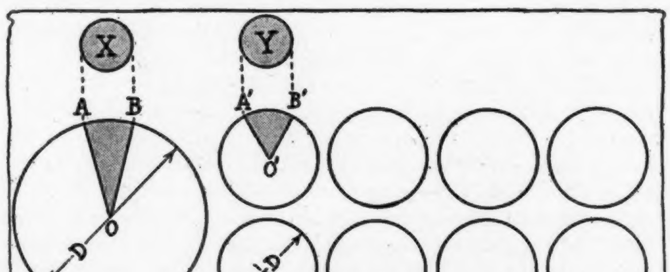

Fig. 3—Particle shown in Fig. 1 greatly magnified
Fig. 4—Showing particle broken up into globules

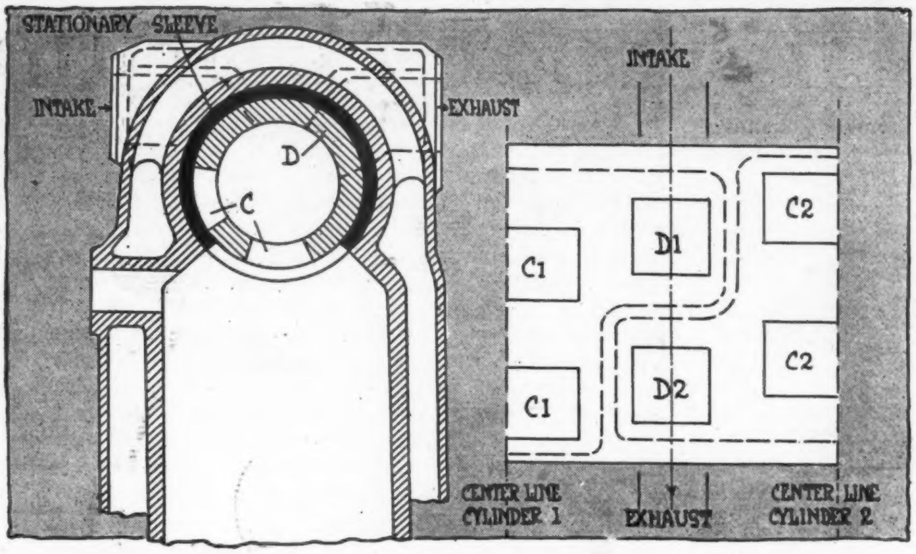

Fig. 13—Type of valve in which the interior forms part of the combustion chamber.

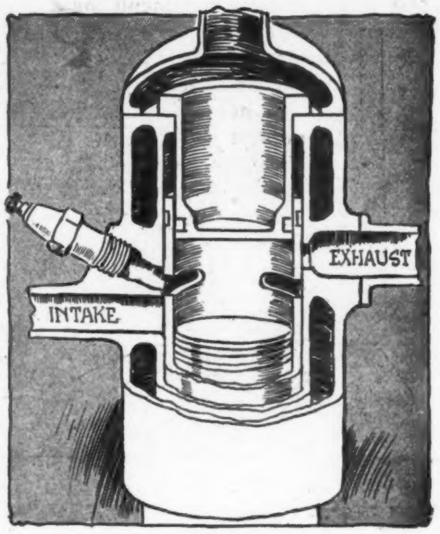

Fig. 14—Rolland-Pilain sleeve valve

Criticisms of Non-Poppet Valves To-Date

Rotary Valve Type as Yet Comparatively Undeveloped, This Group in the Non-Poppet Class Presenting An Extensive Field for the Designers —Excellent Results May Be Expected From Future Research

By Eugene P. Batzell Installment III

THE English valve construction, Fig. 13, is not the only one using the interior of the valve for the combustion chamber. Everything stated in regard to the foregoing valve type applies in a still greater degree to this design. The inside of the valve communicates with the cylinder through ports C and with the inlet or exhaust passages by means of a port D for each cylinder. In the state as represented by Fig. 13 this type of valve should be condemned as entirely inoperative, but energetic shell cooling would improve it.

Though this criticism is impartial, I regret my inability to indicate notable merits in the criticised rotary-valve systems and my standpoint in this respect has been confirmed by the practical experience with those few systems which have been actually built and tried. None of them has yet shown convincing proof of its superiority over other systems and of its reliable functioning. Here is meant a functioning satisfactory to the would-be customer. **This branch of non-poppet valve motors is still in its infancy and subject to much research and development work, but there is a reasonable prospect of good results being achieved.**

Concluding the discussion concerning rotary-valve systems, I wish to draw attention to a combination which has received very little consideration thus far, but which may have future value, namely, external air cooling of the barrel-type valve seats, omitting water cooling entirely. The requirements of proper valve operation are chiefly the permanency of clearance and valve shape, and as exterior air cooling would leave the temperature of the valve seat nearer to the temperature of the valve proper less change in their clearance would result. In addition the valve could be preserved from distortion by using a proper design and annealing it thoroughly, as well as annealing the cylinders. Lubrication

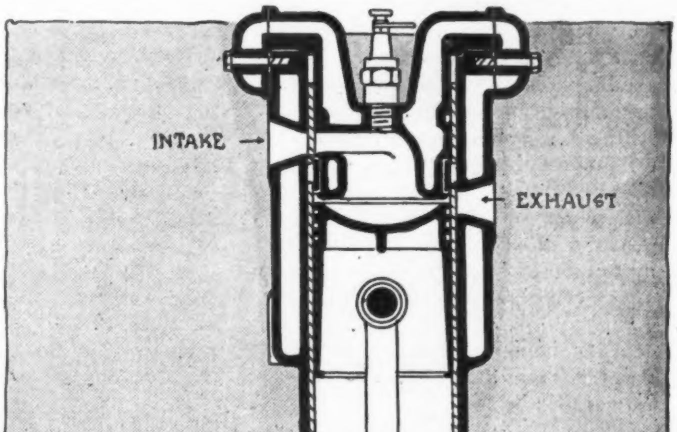

Fig. 15—Wolseley sleeve-valve motor with eccentric actuating mechanism

should not be very difficult because some oils can stand higher temperatures than would be possible in the valve seat.

If the rotary valve has been popular with individual inventors, the reciprocating-sleeve valve has received the attention of quite a number of established automobile manufacturers. Generally this valve gear is more complicated in construction and manufacturing than the rotary type, but the success which has followed the Knight motor and also the experience gained through its use explains this attitude of the manufacturers. In their patents and constructions these other sleeve-valve designers have aimed at more simplicity than the double-sleeve Knight motor offers, and in consequence of this as well as for avoiding interference with the Knight patents, the single-sleeve valve motor predominates in the latest patent issues. It is significant that years ago, at the time of the first rumors of the achievement with the Knight motor, various sleeve-valve patents were taken out covering many kinds of arrangements with two sleeves, differing from the Knight construction in the manner of actuating mechanism and motor cooling, whereas the single-sleeve variety received attention later. To obtain the necessary motor timing with a single reciprocating-sleeve valve the latter must have an irregular motion, and at present this is chiefly obtained by means of a link mechanism with two eccentrics or with one eccentric and one fixed point. Examples representing the above are the Wolseley motor, Fig. 15, for the first and the A. E. G. (German-General Electric Company), Fig. 16, for the second type of link motion. Other characteristic single-sleeve motions are found in the Argyll, Fig. 17, and the Diehl, Fig. 18.

The Rolland-Pilain, Fig. 14, and the Wolseley are very much alike as to the nature and construction of the valve mechanism and some advantage of the second over the first motor can be seen only in the type of cylinder head construction, inasmuch as its sleeve ports are protected from the high explosion temperatures. This has always been considered a good point in the Knight system. Fig. 15 shows the Wolseley motor at the firing moment and it is self-explanatory in regard to the above statement. On the other hand, the original Rolland-Pilain construction, Fig. 14, not only keeps the sleeve ports in the combustion space continuously, but still more, it fires the charge through the intake port by passing it opposite the spark-plug, which is located in the side of the cylinder. The intake port becomes exposed to the highest temperature and also to the action of the initial flame of combustion directed from the spark-plug into the

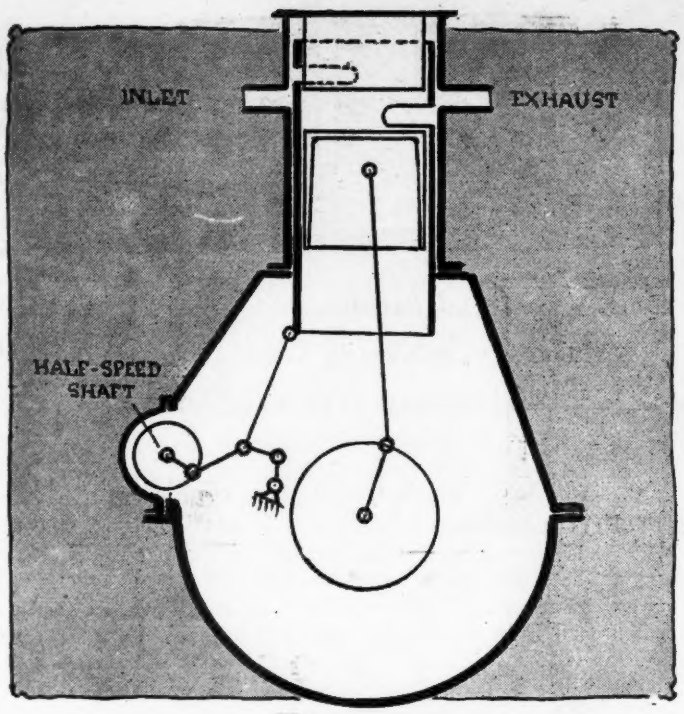

Fig. 16—A. E. G. link motion for actuating sleeve valve

cylinder. It will be remembered that burning out of the ports was a defect sought in the Knight motor which may have caused much of the audible port whistling notwithstanding its port protection.

The A. E. G. link motion, Fig. 16, substitutes an eccentric by a fixed point, thus gaining in constructive simplicity. At the same time it affords material improvement in the shape of the valve opening interval over that of the double-sleeve scheme which has a pointed valve opening curve characteristic of the Knight motor. On the other hand, its mechanism has a number of joints in series whereby any wear will affect the valve motion considerably.

The Argyll system, Fig. 17, is an ingenious example of a combination valve motion being equivalent to a rotary motion of the valve ports in the cylindrical surface, but here again one of the sleeve ports is exposed in the combustion chamber during the explosion. If that is the inlet port it can be covered by the piston for some duration at and near its upper dead center. It remains to be proven by practical use of this motor, how reliable its valve mechanism is, as some doubt in this respect can be freely attached to the present arrangement with its number of cantilever pin-bearing joints.

(*To be continued.*)

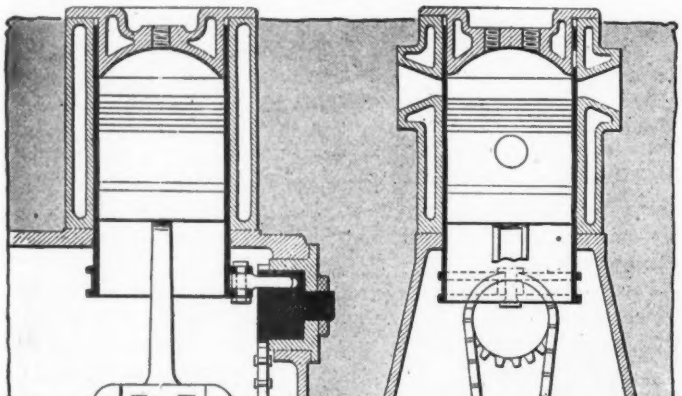

Fig. 17—Argyll single-sleeve valve motor

Loss of Water by Evaporation

Evaporation occurs, for the most part, where alcohol is used as an anti-freezing mixture. Where the alcohol is used in this manner it generally occupies from one-third to one-half the volume of the whole compound. It can readily be seen that this mixture will have a great tendency to be reduced very rapidly. It so happens, however, that the anti-freezing solution is only used at that time when the cooling system is in reality more efficient than is required. On account of the temperature of the air, the motor is not very apt to become overheated. The radiator is generally reduced in effective area during the season of the year that the anti-freezing solution is used, by covering it in some manner. Evaporation in the summer is the only way in which the quantity of water in the cooling system is reduced, if it is in good condition; therefore, loss of water by evaporation becomes merely a matter of watchfulness on the part of the operator.

Bad Valve Adjustment—Carbureter Formula—Painting the Car—Explaining Rotary Valves—Soldering Cast Iron—Civil War Book Gives Roads—Five-Cylinder Question Again—Defining Oversize Bearing—Hup Oiling System

Case of Adjustment Trouble

EDITOR THE AUTOMOBILE:—I have an E. M. F. car which has been causing some trouble for the last few weeks. The engine does not have very good compression. I have just ground the valves and fitted new piston rings. It will fire all right when it is running slow and pulling, but as soon as it is speeded up it will miss. It will also miss when running idle. I have changed the spark plugs, but the missing occurs as before. I have changed the air adjustment on the carbureter.

2.—Why does the small bevel gearwheel in the differential break?

Saylorsburg, Pa. READER.

—It would appear that the cause of your trouble is that the valve tappets are adjusted too tightly. In these motors the clearance has to be .006 inch at least in order to get the power. The machinist who ground your valves has probably left but .003 or .004 inch clearance, and this is insufficient in the case of the E. M. F. motor. If you have a car dated previous to 1909 there are no tappet adjustments, and your trouble is elsewhere. The only other place it could be, unless it is due to a break in the wiring concealed by the insulation, is in the carbureter. The first would cause a misfire that would appear and disappear, and which could only be found by a close examination of the wiring. The carbureter trouble is in the adjustment, which seems to give too lean a mixture. A dirty carbureter causes trouble of a recurring nature and may be remedied by giving the instrument a thorough cleaning. Drain the float chamber two or three times to remove all sediment. Poor gasoline will also cause the trouble you mention. It may be well to try another place for your fuel supply before doing anything else.

2. Because it is not in proper mesh with the large gear. This should be attended to at once by a machinist.

Correct Carbureter for 4-Inch Motor

Editor THE AUTOMOBILE:—What is the proper size carbureter for 4 by 4, four-cylinder, four-cycle motor?

New York City, N. Y. F. M. DOBBS.

—In THE AUTOMOBILE for December 26 a formula for the correct size carbureter is given. This formula is as follows:

$$\text{Size in inches} = \sqrt{\frac{D^2 \times S \times R}{C}}$$

In this formula D is the diameter of the cylinder, S the stroke, R the revolutions per minute, and C a constant which is equal to 50,000 for automobile motors of the four-cycle type. Figuring by this formula, and assuming a maximum revolution of 1600 per minute, the correct size carbureter would be 1.5 inches. The nearest size above that given by the formula should be used in every case. The diameter and stroke of the motor effect the carbureter size; the number of cylinders does not affect the size, but does affect the manifold.

Rejuvenating the Exterior

Editor THE AUTOMOBILE:—I have an automobile that needs considerable touching up in the way of paint. I cannot afford to have the work done by a carriage painter and yet I would like the car to look well. It does not require a very thorough job, and I would like to know through THE AUTOMOBILE how to go about the work myself. The body is metal.

Saratoga Springs, N. Y. J. G. RISING.

—The complete outward renovation of a car is sometimes too costly an operation as outlined. Those who may desire a cheaper and quicker method can begin with the body, presumably of aluminum or some other metal, and have it gone over with a patch of emery cloth, or emery paper, or a fine wire brush, and, in the absence of these mediums, with some coarse sandpaper. Thus rid the surface of foreign substances and condition it to receive and hold the pigment applied to it.

As to the best available primer. Use, if opportunity affords, a purchased ready-to-use metal primer, to be applied with a soft point round or oval bristle brush, the coat being brushed out smooth and uniform. If shop-prepared, use 2 parts raw linseed oil and 3 parts pure turpentine, to a pint of which mixture add a teaspoonful of pale drying japan. For coloring matter and to give body to the primer add enough oil ground lead colored in the direction of the to be finally chosen color. Another primer that some painters have found to work out very strong and well upon the metal surface consists simply of elastic finishing varnish brushed out thinly over the surface.

As soon as the primer is dry, good and secure, beat up some keg lead in 1 part raw linseed oil and 6 parts turpentine, give it the proper coloring, and apply with a soft chisel point brush.

After allowing for secure drying proceed either with a ready prepared knifing material, of which there are numerous makes, or with a shop-mixed one prepared of 3 parts dry white lead and 1 part best bolted whiting, worked into a plastic glazing condition in equal parts of rubbing varnish and coach japan, letting the mass down a bit with a little pure turpentine. Apply with a broad 1-2-inch French scraping knife, half elastic, working the pigment out so uniformly smooth and fine as to necessitate little if any sandpapering.

Permit this coat of knifed-in surface to dry for 48 hours, at which time using first No. 1 sandpaper and last No. 0 to polish with, fetch the work up to a smooth, glassy condition.

Over this foundation lay a coat of color ground work, or, in other words, a coat of color to serve as the ground or foundation color. Prepare this color by using 1 part raw linseed oil to 5 parts turpentine, which, in case of a japan ground color, will furnish requisite elasticity, durability, and a ground color devoid of gloss yet not drying out to a dead appearance—the latter to be avoided at this point in the finish.

In the event of using lake pigments for the final color the next coat over this preparatory ground color should be a coat of the lake whipped in turpentine to dry flat. Then over this use the lake floated in elastic rubbing varnish. When the color is of

the ordinary opaque pigment, or, at most, semi-opaque, such as, for example, ultramarine blue, wine color or carmine, make a varnish color for the opaque pigments, consisting of 1-4 pound of color to 2 pounds of varnish, and for the semi-opaque or transparent pigments, following a solid ground, use 3-4 ounce of color to 1-8 gallon of varnish.

After 36 hours this varnish color, or the transparent glaze, will have dried so that it may be lightly rubbed with water and pumice stone flour to the extent of flicking away any dirt nibs, an elastic body-finishing varnish of the very best grade obtainable should be applied.

For the next coat reduce by one-half the amount of color used in the varnish and apply freely to the surface. Let this coat stand two days, at the expiration of which time again rub with water and pumice stone flour, wash up, stripe and apply such other ornamentation as may be desired. Then apply a coat of clean rubbing varnish. After three days rub this coat moderately with water and pumice stone flour, wash up and finish with an elastic body-finishing varnish of the very best grade obtainable.

Bring the chassis meantime along practically the same lines, using one coat of primer, then a coat of surfacing pigment containing enough raw linseed oil to insure adequate elasticity, upon which foundation use the knifing putty to level up the inequalities of the surface and to "face up" any other existing defects. Sandpaper this body of pigment down sleek and smooth, after which apply one coat of flat color, then one coat of transparent glaze or one coat of varnish color as the requirements of the work may indicate, upon which, in due time, after breaking down the gloss with a light rub-over with a soft sponge, moist and saturated with pumice stone flour, stripe, and apply one coat of clean rubbing varnish.

Give this coat plenty of time to dry, three days or more if possible, then surface thoroughly with water and pumice stone flour, wash up sleek and clean and finish with an elastic chassis finishing varnish.

Duryea Explains Rotary Motor

Editor The Automobile:—Your recent reply to the question of Mr. Lefler in The Automobile December 19, noted. Doubtless you have mixed my present production, which uses engines of the two-cycle type, with the engine which Mr. Lefler refers to. If you will look through reports of the shows 6 years ago you will find that I exhibited at the New York show of 1907 a rotary valve engine having three cylinders, 5 by 5 in a single block, and also a sectioned engine showing just the operation of this new style. I also showed a valve that had been in the hands of a customer for more than 6 months and was in perfect order. My patent on this device is about to issue and antedates other constructions of this kind. It antedates the patent application of the foreign engine mentioned by some years. It is interesting to note that the foreign patent on the engine mentioned was not applied for until some months after the New York show above mentioned.

The two valves are practically the same. In my engines the valve was far enough down the side of the cylinders to permit the piston overrunning the ports slightly, the idea being to oil the valve from the pistons. The engines built by my associates during the present year have had the valve directly on top of the cylinders and fitted with oil cups for taking care of the lubrication. This makes a very symmetric engine. It is interesting to note that I not only originated that type of valve for auto use, but was the first also to use silent chains for driving it; a clear lead of some years over the present silent chain advocates.

The rotary valve is a very sweet running device and well adapted to high speeds. It seems to me well adapted to displace the more common poppet, and the more complicated other forms.

Saginaw, Mich. Chas. Duryea.

Best Flux for Cast Iron

Editor The Automobile:—In soldering the cast iron water jacket on the cylinder of a motor what would be the best flux to use?

2. How is the piston displacement of a motor calculated? Also the radiator cooling surface?

3. What was the result of the fifth annual reliability trials of the Scottish Automobile Club in the Summer of 1909? Is it true that the cup was won by a Knight motorcar?

Detroit, Mich. C. G. Williams.

—1. A flux which can be used to solder the water jacket of a cast iron cylinder is cut muriatic acid, that is, hydrochloric acid in which zinc has been dissolved. For tinning, use four parts of salammoniac solution in water and one part of hot hydrochloric acid. The action can be improved somewhat by sprinkling a little powdered salammoniac on the surface.

2. The rule for finding the piston displacement of a motor cylinder is that of finding the cubic contents of a cylinder, which is as follows: Multiply the area of one end by the length of the cylinder, the product will be the cubic contents of the cylinder. The rule for finding the area of a circle, consists in multiplying the square of the diameter by .7854. The formula for finding piston displacement is: D^2 .7854 S N = piston displacement, in which D is the diameter of the cylinder, S length of stroke, N number of cylinders.

Therefore, to find the piston displacement of a motor with 5-inch bore, 6-inch stroke, and four cylinders, substituting the numbers for the letters of the formula, it would read: 5^2 (five square) $\times .7854 \times 6 \times 4 = 471.2$ cubic inches.

There is no formula for finding the radiator cooling surface necessary for any four-cylinder motor that is applicable to all types and makes of motors or radiators. This is because of the great variation in the cooling efficiency of the various designs of motors and radiators made. Each radiator maker, however, will be able to very closely approximate the amount of surface of its own design most suitable for any particular motor.

3. In the fifth annual reliability trials, held in the summer of 1909 under the auspices of the Scottish Automobile Club, there were sixty-five starters, out of which fifty-eight finished. The trials, which consisted of a combined reliability and economy test, included three hill-climbs and a brake test, lasted 6 days and

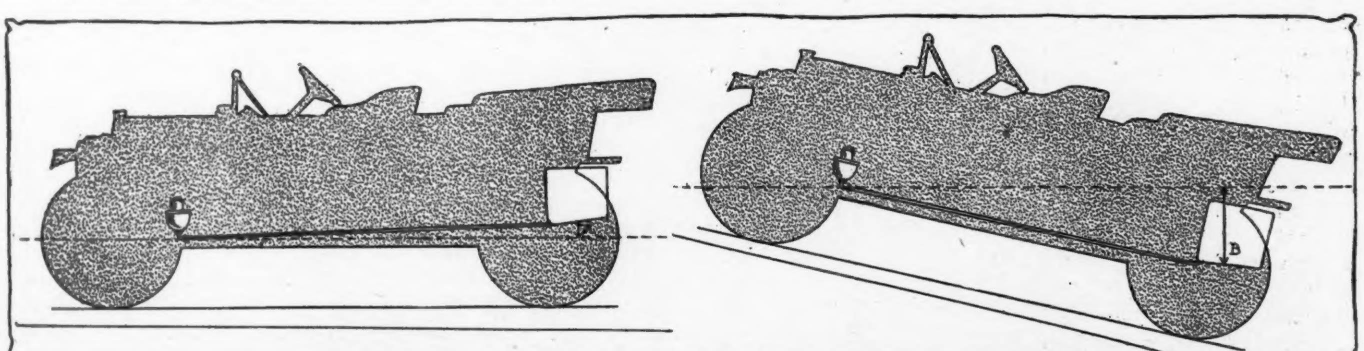

Fig. 1—Showing difference in carbureter and tank relationship when car is on level and hill

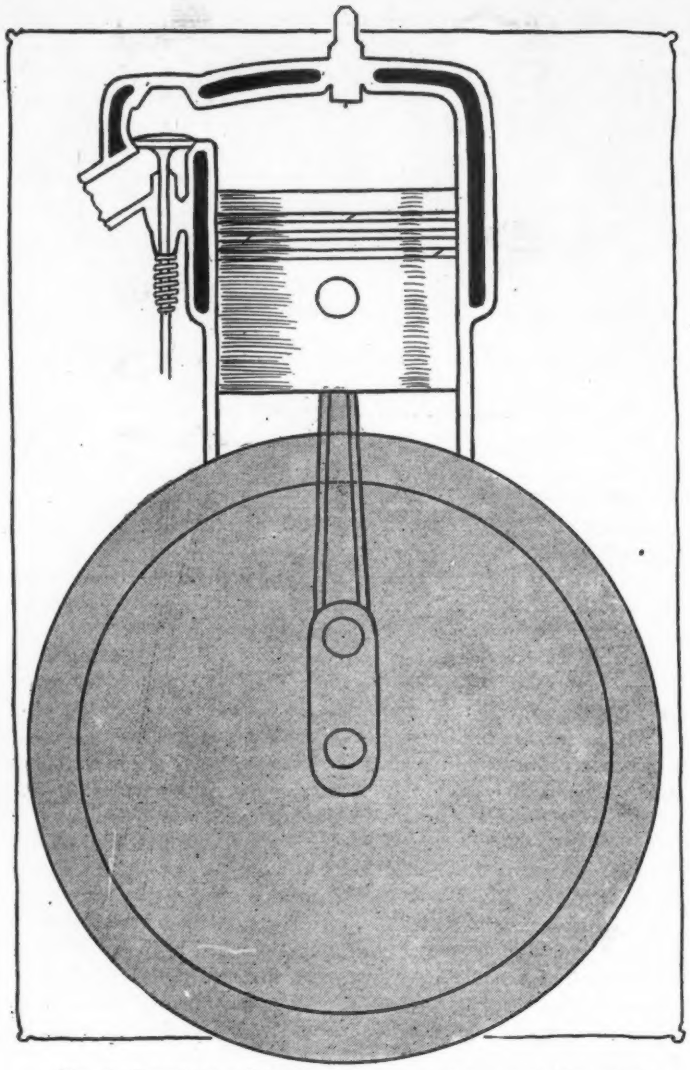

Fig. 2—Flywheel is necessary to carry piston past this point

covered a distance of over 1,007 miles, in stages averaging 170 miles per day at a scheduled speed of not less than 17 miles per hour and not more than 20 miles per hour. The entries were divided into eight classes according to price, and the winner in each class was awarded a gold medal, while bronze medals were awarded each class having the best hill-climbing results. The Scottish cup was awarded to a 38-horsepower Minerva car equipped with a Knight engine. This car also received a bronze medal. No official tests of the Knight motor in its present stage of development are recorded.

Finds Routes in Old Book

Editor THE AUTOMOBILE:—Four or five years ago, when I was devoting considerable time to the laying out of touring routes in the Southern States, I had practically no data at all to use as a basis in laying out my trips. At that time I could not procure anywhere any maps of the Southern States which showed the location of the main roads, and in planning my trips I had to rely on ordinary maps, and to take it for granted that where I saw a number of towns in a line, that there would be a highroad connecting these towns.

In other cases, as, for example, in seeking a road from Macon, Georgia, to Savannah, I simply noted on an ordinary map the general course of the rivers and streams, and laid out a road along what I considered would be high and dry land, and where, as later proved to be the case, there would most likely be found the most "navigable" road.

Recently I ran across a book which contains the best and most complete road maps of the Southern States I have ever seen, and, had I had this work before me when I was touring in the Southern States, I would have saved myself a tremendous amount of miscellaneous investigation, and also a great deal of guesswork.

Nevertheless, to those who wish to cover routes which are not yet included in the Blue Book, I wish to recommend my recent topographical "find." The book I have reference to is "The Rise and Fall of the Southern Confederacy," by Jefferson Davis, published in two volumes, by Appleton & Company in 1881.

In the back of the second volume of this work will be found very accurate and well printed maps which give the exact location of every important highway which existed at the time of the Civil War.

It is almost unnecessary to state that the older a road is, the more likely it is to be the most important in any given locality, for reasons which every tourist will appreciate.

The books referred to above are now out of print, and I have found it impossible to procure a set for my own library, although I have had two of our most important booksellers on the lookout for copies. The books may be found, however, in all the important public libraries, and the maps above referred to are well worth the inspection of every one who is interested in touring in the Southern States.

New York City. R. H. JOHNSTON.

More on Five-Cylinder Motors

Editor THE AUTOMOBILE:—It is very evident that I failed to make myself clear in a previous article on five-cylinder motors, and I would like to have it understood that I did not intend to convey the meaning that such motors were not successful. In my comparison of five and six-cylinder motors (which was based on facts and not on my opinion), I picked out the advantages of one over the other in their most important points, and although I found the former a successful motor and just as superior to a lesser number of cylinders as one would expect, I take exception to any statement that puts it on an equal with the six. One cannot fairly take into consideration the consumption of fuel and oil, in these two motors when comparing their superior qualities for motor car propulsion. If so we would have to admit the single cylinder as the most successful.

In the issue of THE AUTOMOBILE of November 28 I gave an illustration of motors operating without flywheels, and I did this for the purpose of showing that only theoretically do five cylinders produce a constant torque. A motor that requires a balance wheel to carry it over certain dead or slack portions does not produce a practical constant torque. In this motor (five-cylinder) the explosions overlap each other to the extent of 36 degrees, and as the actual working stroke of a gasoline motor starts not sooner than 10 degrees past top center and ends not later than 150 degrees, it shows an interval of 6 degrees when no power is being generated. Some manufacturers confine this working stroke to 120 degrees. In the cost of manufacturing the crankshaft of these motors there would be a difference of about one hundred dollars, the five costing that much more than the six, and it would be necessary to eliminate more than one cylinder and its parts to make up this difference.

Certain approved methods such as casting cylinders in pairs and four bearing crankshafts, would have to be abandoned for the unapproved or obsolete in order to adopt the five-cylinder motor.

In regard to the motor being lighter and allowing the hood to be shortened, I will say that the average engineer will not consider such attempts at the expense of the smooth and silent operation of the car, especially when the saving in weight would hardly be noticeable either in the life of the tires or the operation of the car.

Portland, Me. GROVER C. RICHARDS.

What Is an Oversize Bearing?

Editor THE AUTOMOBILE:—What is an oversize bearing? I should like to have you decide a question which I have argued

with a friend. I had occasion to have a cut taken off a crankshaft which had been scored and stated I wanted an oversize new bearing put in. Issue was taken with me for calling it an oversize bearing, he stating that as the crank hole diameter was smaller in the new bearing and consequently its bearing surface smaller, it should be called an undersized bearing.

I maintain that as the radius center of crankshaft to outside of bearing is fixed in any particular engine the mere fact of taking a cut off the crankshaft makes it undersize and consequently the new bearing becomes oversize. In other words, you cannot fit an undersize bearing to an undersize crank when the radius center of crankshaft to outside bearing is fixed and remains so.

Cincinnati, O. A SUBSCRIBER.

—An oversized bearing on the crankshaft is one in which the fit is too loose. That is to say, the bearing with the greatest internal radius is a larger bearing. Therefore, your friend is right and you are wrong. The size of the bearing is measured by the diameter of the circle which would be formed by a section through the bearing at right angles to the axes of the shaft. You are thinking of the thickness of the bearing metal, which does not affect the size of the bearing.

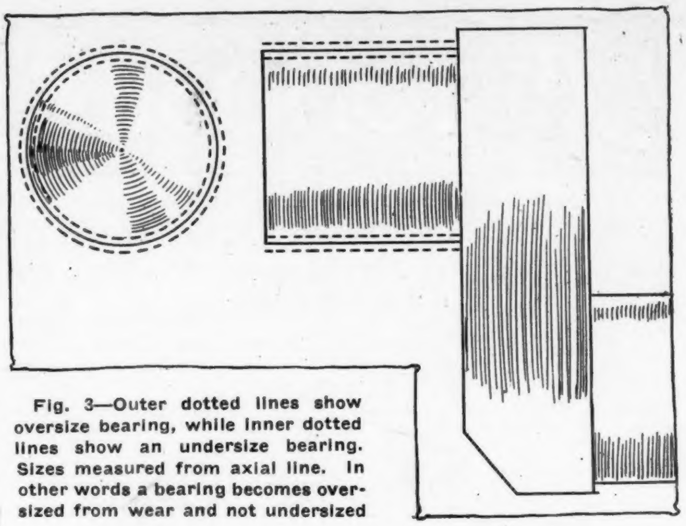

Fig. 3—Outer dotted lines show oversize bearing, while inner dotted lines show an undersize bearing. Sizes measured from axial line. In other words a bearing becomes oversized from wear and not undersized

Getting the Car Weighed

Editor THE AUTOMOBILE:—I notice in the tire tables that the different loads are given for the front and rear axles separately to determine the correct size of tire. Would you tell me how to get these weights correctly.

2. Why is it that pressure feed is used when the tank is flung at the rear? Cannot the carbureter be placed low enough for gravity?

New York City. J. E. S.

—The correct method of weighing a car given in Fig. 4.

2. In order to make the carbureter high enough to be accessible it is necessary to use pressure feed when the tank is carried at the rear. This is brought out in Fig. 1. When the car is on level ground the feed may be by gravity but while on a slope pressure would be necessary.

Oiling System on New Hup

Editor THE AUTOMOBILE:—Would you kindly tell me if the same oiling system is used in the new Hup 32 as in the Hup 20-horsepower runabout? The latter, as you will remember, used a gravity-feed system by which oil is fed to the crankcase by gravity, the amount fed being governed by a cam arrangement on the throttle control.

Denver, Col. L. C. SMYTH.

—The automatic oiler on the Hupmobile 32 makes use of a flywheel of the motor and of centrifugal force. The lower part of the crankcase and the flywheel housing are integral. The crankcase slopes downward toward the flywheel compartment, and oil runs into this lowest point which is designed as the oil pan. The flywheel rim is close to the bottom of this oil pan at its deepest part. When the flywheel revolves, some of the oil in this pan or sump through which the rim travel, adheres to the rim and is carried around with it. Half way up on the right inside of the flywheel case there is a horizontal rib which is machined to just clear the rim of the flywheel. The oil adhering to it is thrown with considerable force against this rib and into a tube which enters the housing just below the rib. The oil passes through the tube to a strainer contained in the filling tube casting. This strainer is 3 inches in diameter and is set vertically so that all grit and sediment collect at the bottom, where they may be washed out by opening a pet cock while the engine is running. From the strainer the oil passes into a 1-2-inch horizontal duct cast in the crankcase. Three 1-4-inch tubes conduct the oil under pressure of the flywheel's centrifugal force to the centers of the main bearings of the crankshaft.

Quarter-inch holes drilled in the crankshaft allow the oil to flow to the crankpin bearings. The oil spray flung from the ends of these bearings is sufficient to lubricate the cylinders under ordinary conditions, but as an additional precaution, oil leads are provided direct from the distributer pipe to the points between cylinders Nos. 1 and 2, and Nos. 3 and 4. These force oil into the hollow piston pins and fill the grooves around the pistons. The camshaft bearings are lubricated by the splash of the connecting-rod ends in the sumps at the bottom of the crankcase. Oil thrown from the flywheel toward the rear goes into the gear case and maintains the proper level for the gears. The excess oil is returned to the crankshaft, due to the sloping construction of the housing. Grit and sediment from the gears are retained in a settling basin, and may be removed by taking out the large drain plug.

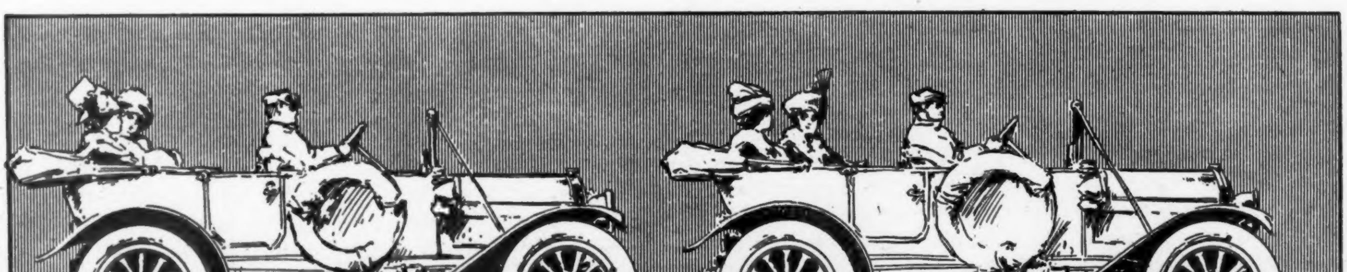

Fig. 4—Method of weighing car. First, to get load on front axle; second, total load; third, rear axle load

The AUTOMOBILE

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The Strength of Union

IS it better for both passenger and commercial electric vehicle makers to stand aloof from gasoline makers of passenger and commercial vehicles, or to work hand in hand with them?

There is only one answer to this question, namely, "Get together, it is the motor-vehicle-against-the-horse problem that has to be solved and not whether it shall be electric or gasoline vehicles."

Makers of electric passenger vehicles recognize that they cannot compete with the gasoline passenger vehicle except in city and intercity work where the distances are not too great. Makers of gasoline passenger vehicles recognize in the electric passenger car a vehicle of general utility for such services; and they further recognize the extent to which the closed type of electric supplements the open type gasoline vehicle, where the two are in the hands of the same owner, one for fine-weather country or city use and the other for all-weather city and suburban service.

Makers of electric commercial vehicles recognize the limitations of their vehicle as compared with the gasoline type for long-distance work; and on the other side of the fence the gasoline maker gives due heed to the ideal adaptation of the electric for city use with short-distance hauls and the varied conditions of traffic congestion.

What is the net result? Get together. Combat the common enemy. Work hand in hand for better traffic control; for improved city railway and steamboat terminals; for necessary renovation of internal systems in business houses which will reduce lost time in loading or unloading; and work for the rational education of the buyer.

Beyond the Horizon

WHEN will the day come when the owner of an electric passenger vehicle can start from his New England home and tour to Denver, Col., without more loss of time than required to remove the discharged battery at convenient charging stations along the road anad install a full-charged one?

When that day arrives the electric passenger and electric commercial vehicles will have attained their maturity.

Such a conception of affairs is not entirely utopian. There are many fibers of rationalism in its warp and woof. It presupposes very considerable progress. It can only be achieved when batteries and other parts have been well standardized. It can only be achieved when central stations or other interests have installed charging plants at intervals of 75 to 100 miles distance from one another over the country; it can only be attained when batteries are owned and controlled by some combination of the central station and battery-manufacturing or other interests; and it can only be attained after the adoption of some general plan whereby the purchaser of a vehicle buys it without a battery and when using two dozen different batteries between Boston and Denver pays in addition to the cost of current a rental for the use of the different batteries.

A looked-for condition of this nature is in the minds of nearly every maker of electric vehicles. True, the conception is embryonic, vague, undefined; but in every case the feeling is one of certainty as to its eventual evolution. The question of battery ownership is the major element calling for solution.

If battery ownership rests with the owner and he or she starts with a new battery from Boston he or she has it but for a single day, and may never see it again on the 2,000-mile trip. Instead of a new battery every day he or she may have to use old batteries of reduced capacity.

Should the battery ownership rest with the chain of charging depots then the owner would have to pay for current and battery rent and would have the privilege of purchasing the vehicle without a battery. Such a free exchange of batteries would call for requisite standardizing of battery trays, and control features, motors, etc.

Climbing the Ladder

LIMOUSINE body types, longer wheelbases, more accessible batteries, more fool-proof control, approaching battery standards, attempted regulation of vehicle speeds or recommended practice in such, dropped frames, improved springs, shaft drive or inclosed methods, etc., are a few of the new rungs added to the ladder of electric vehicle progress.

All indicate that the electric vehicle maker is aiming to impress on the buyer the paramount fact that the electric passenger vehicle is a general utility vehicle the same as the gasoline machine.

With the electric commercial vehicle there is a pronounced movement to enlarge the number of models to take in the varied requirements of every industry.

Salon Breaks World's Record for Exhibitors

PARIS, Dec. 22—With the record number of 550,000 persons having paid for admission, the thirteenth French automobile show closed its doors this evening after having been open 16 consecutive days. No accurate record has been kept of the number of persons having entered the big hall with free tickets, these persons comprising stand attendants, agents, officials, pressmen, and persons having received invitations on the opening day. It is estimated that altogether nearly one million persons must have entered the Grand Palais while the show has been in progress.

It is evident that the show which has just been brought to a close is the most successful ever held in France. Gate receipts are about $6,000 in excess of the best previous year; the amount paid for the rental of stands is $40,000 in excess of the previous record, and the 568 exhibitors is the highest number recorded in any show in any part of the world. These 568 exhibitors occupied 260,000 feet of floorspace, paid at rates varying from $50 to $60 per square yard.

In an interview with THE AUTOMOBILE representative, Henri Cezanne, general secretary of the show committee, stated that the organization of the show had cost from $250,000 to $300,000, this being the largest amount ever spent on any automobile show. The electric light bill worked out at the rate of $500 an hour.

"It has been decided," declared M. Cezanne, "to hold an automobile show in Paris next year, most probably during the month of October instead of the month of November. This change of date will be adopted in order to diminish as far as possible the present annual slack season. It is found that there is a falling off in the amount of business done from the month of July, and the increase in business is not felt until after the show. If the show is not held until the month of December the slack season is felt more or less for 4 months. If the show is held in October, this period of slackness will only last for 2 months."

Up to the present the London show has opened the European series, and the British trade has always laid emphasis on the fact that London was the centre of the European automobile trade. The unprecedented success of this year's Paris show has begun to shake the Englishman's belief in the impregnability of Olympia, and with such natural facilities as the French enjoy in the Grand Palais and the determined effort they are now making to retrieve their former mistakes, it hardly seems possible that London can remain more important than Paris as a trading centre.

"Personally I do not consider that an annual show is worth while," explained M. Cezanne, "and there are plenty of manufacturers who are of my opinion. Experience has shown us that the annual show does not increase the volume of business. It undoubtedly helps the small firms to come to the front, and it enables foreigners to get on our market. It is really more advantageous for us to take part in shows in foreign countries than to exhibit at home. The settled condition of automobile design is another reason why shows should not be held every year. Although 2 years have elapsed since a show was held in Paris, the mechanical changes are not of sufficient importance to necessitate such a costly demonstration as the Paris Salon.

"Until we can come to an agreement with the English manufacturers, by which the two shows will be held every 2 years—not alternatively—we shall be obliged to hold a show in Paris every year. A show in Paris one year and in London on the following year is not desirable, for practically the same preparations have to be made by our manufacturers to exhibit in London as to participate in the Paris show. This arrangement therefore amounts, practically, to an annual show. As soon as the English declare that they are ready to work with us in the organization of shows every 2 years we shall abandon the annual exhibition."

"Business has been excellent," declared M. Cezanne. "It is obviously impossible to state what amount of business has been transacted with the Grand Palais, but in every section of the show—car manufacturers, body makers, tire makers and dealers, accessory dealers—the statement is made that business has been decidedly brisk."

Out of the profits of the show 40 per cent. is returned to the exhibitors in proportion to the amount paid by them for the rental of stands; 40 per cent. is returned to the exhibitors who for 6 months have been members of one of the organizing trade associations, and 20 per cent. is paid over to the 5 organizing associations in proportion to the amount paid by their members for stand rental.

The Paris salon is admittedly the most important social function of its kind. The decorations and illuminations are designed to attract the attention of the wealthy classes, yet the price of admission is kept sufficiently low to suit practically everybody, being only 20 cents on all days but Fridays and the opening day, when it is increased to 60 cents and $1, respectively. The Republican Guards military band is secured for the opening day, this band being recognized as the finest of its kind in Europe. On all other days a very high class orchestra is secured, and on Fridays there is in addition a short concert with singers from the National Opera House. It cannot be denied that these attractions bring into the hall the right class of prospective automobile buyers.

The show has always closed its doors at 6 o'clock. This year, by special request, they were kept open until 6.30 o'clock, but on a careful account being taken it was found that the number of people entering during this last half hour was only 31. As the additional half hour entailed an additional expenditure of $300 for light and attendance, the experiment was naturally looked upon as a failure.

One of the most valuable conveniences in the hall was a system of electric lights to indicate the position of stands. On large boards near the main entrance a plan of the entire show had been prepared, and in the center of each stand marked on the plan a small electric lamp had been fitted. By the side of the board was a complete list of firms exhibiting, with an electric light button immediately after the name. By pressing this button a red light was made to appear on the stand shown on the plan. As a rapid means of finding the location of any stand it was most valuable and was highly appreciated by the visitors.

Philadelphia Show Has Sixty Exhibitors

PHILADELPHIA, PA., Dec. 28.—Drawings for the allotment of exhibition space to local pleasure car and accessories dealers, to hold forth during the first week of the twelfth annual Philadelphia Automobile Show at the Automobile Club of Philadelphia's building, Twenty-third and Market streets, January 18 to February 1, were held on Thursday and show a total of over sixty different makes of gasoline and electric cars, handled by dealers affiliated with the Philadelphia Automobile Trade Association, under whose auspices the exhibition will be conducted. This number will be considerably augmented next week when dealers not members of the association will draw for space. The opposition show to be conducted by the Philadelphia Automobile Board of Trade, Ltd., at the First Regiment Armory, Broad and Callowhill streets, during the week of January 18 to 25, will make a feature of foreign-built cars in addition to representative American cars.

After Big Races for 1913

Both Milwaukee and Savannah Want the Grand Prix and Vanderbilt Cup Contests This Year

Committees To Visit New York Regarding the Matter in the Early Part of This Month

BOTH Milwaukee and Savannah want the big cup races for 1913. They have not been awarded so far but the following items show the interest and hope of the cities actively campaigning for them.

MILWAUKEE, WIS., Jan. 1—It is announced today on the very best of authority that Milwaukee will stand sponsor for the international road races, the grand prix, Vanderbilt cup, Pabst trophy and Wisconsin Challenge cup races in 1913, if the governing bodies, the Automobile Club of America and the American Automobile Association will again consider its tenders favorably. Immediately after the fifth annual Milwaukee motor show, which is to be given in the Auditorium from January 11 to 17 inclusive, the Milwaukee Automobile Dealers' Association, will begin preparations for its campaign to land the classics a second time, and a delegation will leave for New York to make its tender to the governing body.

SAVANNAH, GA., Dec. 30—The date and other details of the Grand Prix and Vanderbilt cup automobile races, which will in all probability be held in Savannah, over the famous Chatham County course, either in the fall of 1913 or early in 1914, will be arranged at a meeting to be held in New York on January 6 between the Motor Cups Holding Company and a sub-committee from the executive committee of the Savannah Automobile Club.

The committee will leave Savannah Saturday night, January 4, reaching New York the following day. The meeting will be held at the Waldorf-Astoria on Monday, January 6.

It is stated by President Granger that there is a possibility of the races being held on February 22, 1914, instead of Thanksgiving Day, 1913, as heretofore, the former date being favored by the Automobile Club of America.

Records Broken in Iowa Road Run

DAVENPORT, IA., Dec. 29—All records were shattered for daylight run across Iowa yesterday when Don McClure, Oskaloosa, driving two-passenger Oakland torpedo, won the 321-mile race by 35 minutes over Pete Petersen, Davenport, driving five-passenger Pope-Hartford. McClure's total time on the road was 10 hours and 43 minutes while Petersen took 11 hours and 18 minutes. McClure's running time was 9:20 and Petersen's 9:24.

The race was arranged by the Tri-City Ocean-to-Ocean Official Highway Association to determine whether the River-to-River road or Great White Way was the better route between Davenport and Council Bluffs. Petersen drove over former and Oskaloosa man took the southern route. The River-to-River road is 346 miles and the Great White Way 321 long but drivers raced on equal terms. Average time of winner 37.8 miles per hour.

More Space Available for Chicago Show

Many belated applicants for space at the Chicago Automobile Show, who have been greatly disappointed by the fact that no more exhibition space was to be had in the Coliseum, Annex or First Regiment Armory during either the first or second week of the show, will, after all, be given exhibition space. By one of his customary enterprising business deals, Manager S. A. Miles has secured the use of the Wilson building, adjoining the Coliseum Annex on the South, for the show period. This building is practically the same size as the Annex and the floors are free from obstructions of any sort. This will enable the largest passenger cars and motor trucks to be shown to advantage without any interference by posts or low ceilings. The building has a main entrance on Wabash Avenue, but by opening passage ways through the south wall of the Annex, it can be made to all intents one building with the Coliseum, so that space in it will be even more desirable than in the Annex.

With these additions the count of exhibitors in the show will be as follows:

Passenger car manufacturers, 102; commercial vehicle builders, 77; accessories manufacturers, 244. Most of the accessory exhibits will remain in place throughout both weeks.

Spaces in the Wilson building have been taken by the Mercer Automobile Co., and Midland Motor Car Co., previously allotted Annex basement spaces; Paige-Detroit Motor Car Co., allotted space in the Armory; and the W. H. McIntyre Co. The Republic Motor Car Co., of Hamilton, O., and Century Electric Car Co., of Detroit, Mich., have accepted the basement spaces thus made vacant.

The new motor truck exhibitors who have accepted offers of space are the Grand Rapids Motor Truck Company, of Grand Rapids, Mich., Driggs-Seabury Ordnance Corp., Sharon, Pa., Randolph Motor Car Co., Chicago, Edwards Motor Car Co., New York, and the O. Armleder Co., Cincinnati.

Notice to New York Show Exhibitors

Merle L. Downs, secretary for the coming automobile shows at New York, has issued the following statement:

In order that there may be no misunderstanding in regard to shipment of exhibits, or delay in receiving same at this end, we call your attention at this time to paragraph 11, of the rules, copy of which has been sent you, and which is included in your contract for space, with reference to shipments, and especially to that portion of the same, which states all freight and express charges must be prepaid, or the goods will not be accepted by the management.

This is important, so kindly see that the necessary instructions are given your shipping department at this time.

We also desire to remind you that in view of the prevailing freight situation, and the fact that it is not always possible to get freight cars on short notice, that after a consultation with the traffic department, would suggest that you place orders promptly with the railroad for cars to take care of your usual shipments in ample time, so that there will be no delay in getting your exhibits here in time for the opening. We bring this matter to your attention, owing to the numerous inquiries that have been made from exhibitors on the subject.

Lanchester Brings Out Vibration Absorber

BIRMINGHAM, ENG., Dec. 21—F. W. Lanchester, consulting engineer of the Daimler Company, has recently brought out a vibration absorber for four-cylinder motors. It consists of a twin cross-shaft driven from the motor crankshaft and carrying balance weights, which revolve at double crankshaft speed. Mr. Lanchester in speaking of the necessity for such a device on a four-cylinder motor recently stated: "The orthodox form of four-cylinder engine is correctly balanced so far as the primary reciprocating forces are concerned, but the secondary balance is appreciably bad, and at high speeds causes much vibration. This lack of secondary balance is due to the effect of the comparatively short connecting rods which cause the motion of the piston to differ from the ideal harmonic. In a four-cylinder engine with 4-inch stroke and pistons weighing two pounds each this secondary unbalanced force at a speed of 2000 revolutions per minute exceeds 400 pounds."

Tire Plant for Louisville

Speedway Tire Company Organized by Louisville Men To Make Three Standard Types of Vehicle Tire

Willys Elected President of Gramm Truck Company—Car Census of the United Kingdom

WITHIN the next 90 days Louisville expects to boast of the only tire factory south of the Ohio River. The concern is the Speedway Tire Company, which has on hand $250,000.

All money is in and more than 65 per cent. of the capital stock is held in Louisville. The officers of the new company are Harry L. Lewman, of the Lewman-Cox Realty Company, president; L. D. Lewman, of Atlanta, president of the Manhattan Construction Company of New York, vice-president; Fred Haupt, of Louisville, second vice-president; W. N. Cox, president of the Louisville Public Warehouse Company, treasurer; and Dr. Fred L. Koontz, secretary. G. W. Greene, a tire expert of Massachusetts, will have charge of the new plant.

Two sites for the factory are now under consideration. The plant, according to present plans, will be placed in a factory building, which will be altered to suit present needs. A lease with a buying option will be taken. As soon as it is known what are the needs of the new company, the concern expects to build a modern tire factory eight stories high of concrete, steel and glass construction.

At first only motor vehicle tires of three standard types will be manufactured. The output will be about 100 tires per day. Pneumatic and solid automobile tires will be the principal product, but the firm will also make rubber mechanical goods and druggist supplies. About 300 men will be employed in the plant.

Willys Elected President of Gramm

TOLEDO, Dec., 27.—John N. Willys, president of the Willys-Overland Company, Toledo, was elected president of the Gramm Motor Truck Company, at the annual meeting of the stockholders of the corporation in Lima, O., Thursday evening, December 26. Mr. Willys has announced that the facilities of the plant will be doubled early in the new year and that the company will install special equipment for the building of a .75-ton truck to be placed on the market at a moderate price. The plant is now turning out 5-ton trucks. It is also announced that H. H. Doehring, for several years general sales manager of the Ohio Electric Car Company, has been made sales manager of the Gramm Motor Truck Company, with headquarters at Lima.

N. A. A. M. Establishes Office in Detroit

DETROIT, MICH., Dec. 30—The National Association of Automobile Manufacturers has established a traffic office in Detroit, in charge of J. A. Gardner, formerly traveling manager for the Brush and later with the Stoddard-Dayton, of Dayton, Ohio. Some of the work of the New York office will be transferred here and the local office will take up the matter of securing better transportation facilities for Detroit automobile manufacturers.

Car Census of United Kingdom

LONDON, ENG., Dec. 21—Among other interesting information contained in Lord Montagu's weekly journal, *The Car*, the car census reveals in a convincing manner the growth of the motorcar in these islands. To begin with there are 320,119 motor vehicles of all types in the United Kingdom, compared with 266,258 of last year, representing an increase of 53,861, while the total number of persons holding driving licenses is 284,799, of which 19,635 hail from Scotland and 10,626 from Ireland. With regard to the distribution of the cars throughout the United Kingdom, England and Wales, including the county boroughs, possess 156,573 motor carriages and pleasure cars, 116,248 motor-cycles, and 11,771 heavy commercial motor vehicles. The actual figures for the city of London are not only interesting but also instructive and convey to the lay mind the increase that is taking place annually. There are 55,912 motorcars, 20,654 motorcycles, while there are no fewer than 4,868 industrial motor vehicles registered in the metropolis. The London County Council have issued 49,482 licenses to drivers during the past twelve months, while the metropolitan police issued up to October 31 licenses for 7,896 motor-cabs, and 2,677 motor-omnibuses, as compared with 7,476 cabs and 1,883 motor omnibuses at that date 12 months previously.

Flanders Mfg. Co. Creditors to Present Claims

DETROIT, MICH., Dec. 30—*Special Telegram*—The Detroit Trust Company, receiver for the Flanders Manufacturing Company of Pontiac, has notified creditors to present their claims within 90 days, at which time an attempt will be made to have the property appraised. The factory is running at present. At the end of 90 days the creditors will hold a meeting, with the receiver, for the purpose of determining the future of the concern.

Winton Chauffeurs Get Cash Awards

The annual award by the Winton Motor Carriage Company to chauffeurs of Winton cars whose mileage was high during the past year with a minimum of repair expense has been made. The first prize of $1,000 went to a Boston chauffeur who submitted sworn affidavits by himself and his employer that he had driven the car 26,987 miles with no repair expense.

Nineteen other awards were made ranging from $500 to $100.

The plan followed by the company in determining who should receive the awards is to have the chauffeurs and owners report monthly to the company and the reports and affidavits are submitted to a committee of five which makes the awards.

Award	Driver	Place	Mileage	Repair Expense
$1,000	J. L. Dondero	Cleveland, O.	26,987	...
500	W. J. Green	Chicago, Ill.	22,928.8	...
250	Thomas Murren	Medford, Mass.	16,477	$0.95
150	Albert Bedard	Providence, R. I.	18,245.3	18.01
100	E. P. Brubaker	Chicago, Ill.	15,729	...
100	J. W. Tracy	Crafton, Pa.	14,022	...
100	J. F. Folger	San Francisco, Cal.	14,474	.75
100	F. Schneider	New York City	14,431	...
100	H. Decker	Newburgh, N. Y.	12,541.8	...
100	L. V. Wright	New York City	12,716	.15
100	A. N. Peters	Brighton, Mass.	13,845	.95
100	E. A. Hodge	Milford, N. H.	13,441	21.22
100	Harry Batch	N. Braddock, Pa.	15,333	53.65
100	S. J. Meneely	Newburgh, N. Y.	11,743.3	25.35
100	J. L. Scott	Philadelphia, Pa.	12,271	25.35
100	J. H. Gallo	New York City	11,307	...
100	Wm. Ahrens	Brooklyn, N. Y.	11,150	...
100	E. E. Stokes	Philadelphia, Pa.	11,126	...
100	Clarence Finley	Chicago, Ill.	11,119.5	1.25
100	Wm. J. Armstrong	Philadelphia, Pa.	10,870	.85

Date Set for Du Brie Hearing

DETROIT, MICH., Dec. 30—The DuBrie Motor Company, adjudged bankrupt October 4, has filed a petition in the United States court, asking a full discharge of all debts provable against it under the bankruptcy acts. Judge Arthur S. Tuttle has set February 3 as the date for a hearing and has notified creditors to appear at that time and show cause, if any, why the prayer of the petitioner should not be granted. The company declares it has surrendered all its property and rights of property and has fully complied with the requirements of the bankruptcy acts.

Pelletier and Smith Leave Flanders Co.

Advertising and Sales Managers Suddenly Sever Their Connection with New Subsidiary of U. S. Motors

Flanders Company Files $600,000 Mortgage to Secure Bond Issue—Speedwell Issue Subscribed

DETROIT, MICH., Dec. 30—*Special Telegram*—E. Leroy Pelletier, advertising manager, Flanders Motor Car Company, and Paul Smith, sales manager, severed their connections with that concern on December 28. No statement from the parties concerned nor from the officers of the Flanders Company could be obtained today relative to the reasons for the move. Since the merger of the Flanders Motor Car Company with United States Motors, there has been considerable speculation as to whether these men would assume the same positions with the parent organization, and Saturday's move is the answer.

A newspaper report here today states that Pelletier and Smith were advertising and sales manager, respectively, of the United States Motors Company at the time of their resignations, but this is incorrect. They were connected with the Flanders subsidiary only and were not in the employ of the United States Motors in any capacity.

Semi-official confirmation of the fact that Smith and Pelletier have quit the Flanders Motor Company has been received in New York. It is also stated that while they were slated for the positions of sales manager and advertising manager of the contemplated reorganization of the United States Motor Company, their appointments had not been made officially.

The report from Detroit states that the split occurred last Saturday but the reasons underlying it were not outlined.

The whole industry as represented in New York displayed the keenest interest in the report but could add nothing to it.

Flanders Files $600,000 Mortgage

DETROIT, MICH., Dec. 30—The Flanders Motor Company has filed with the city clerk copies of a $600,000 chattel mortgage, running to the Central Trust Company to secure an issue of 6 per cent. 3-year gold bonds, arrangements for which were made with the New York concern some time ago.

Speedwell Bond Issue Subscribed

DAYTON, O., Dec. 27—Stockholders of the Speedwell Motor Car Company, Dayton, O., met in that city last Tuesday and ratified the plan recently projected to authorize a bond issue of $150,000 for the extension of the business. This issue has not been subscribed, according to the company. It was also decided to increase the directorate of the corporation. President Pierce Schenck stated that Fred A. Funkhouser, president of the Winters National Bank of Dayton, will be one of the new directors. W. L. Caten was elected vice-president and general manager of the company at the Tuesday afternoon meeting. The Mead sleeve engine will be used in the cars of the concern in the future, and leading stockholders of the Mead Engine Company will take stock in the Speedwell Company and the plant will be enlarged.

Grabowsky Sold—Lion Sale Postponed

DETROIT, MICH., Dec. 31—*Special Telegram*—The referee in bankruptcy today accepted the offer of Samuel Winternitz and Company, of Chicago, for a part of the property of the Grabowsky Power Wagon Company. Winternitz and Company will sell the material and machinery and turn $55,000 over to the referee. The bid covers everything but the land, buildings, equipment, book accounts and bills receivable. The real estate will be sold by the referee at auction January 23 at the plant.

The sale of the Lion Motor Company property at Adrian, Mich., has been postponed by the referee for the second time. On the date first set for the sale the highest bid was $7,000 for property appraised at about $33,000. On December 24 another attempt was made to sell the property but on that occasion the highest bid was $12,250, this being from Samuel L. Winternitz of Chicago. This sale likely will be confirmed unless a bid of $12,750 is received before the date set for the sale.

A delegation of Adrian business men were in Detroit when the sale was postponed for the second time and members stated they believed they could procure a buyer who would pay $12,750.

Gear Company Changes Its Name

ALBANY, N. Y., Dec. 28—The New Process Gear Corporation has been incorporated in Albany with a capital stock of $1,000,000, all subscribed. The new company will, on January 1, take over the stock of the New Process Raw Hide Company.

Originally the manufacture of rawhide gears was the principal business of the company. Now it makes both metal and rawhide gears, the production of metal gears being many times greater than that of rawhide.

The New Process Company is now doubling its plant and capacity. A large extension to the factory in Plum street is nearing completion and will be wholly occupied when it is completed.

Freight Car Shortage Slightly Less

While demand for freight cars is still unprecedentedly severe, another reduction in the net shortage was reported by the American Railway Association for the fortnight ending December 14

Automobile Securities Quotations

AUTOMOBILE and accessory securities had a quiet week on the bourses. The general tone was firm but in the limited trading, due to the holidays, the market trend was somewhat irregular. Tire stocks were the strongest feature of the market with Goodyear and Firestone close to the record mark. Compared with the level of the last day of 1911, stocks show a material advance.

	1911		1912	
	Bid	Asked	Bid	Asked
Ajax-Grieb Rubber Co., com	..	..	180	200
Ajax-Grieb Rubber Co., pfd	..	..	96	100
Aluminum Castings Co., pfd	..	..	99	101
American Locomotive, com	36	37	41½	42½
American Locomotive, pfd	105	106	106	107
Chalmers Motor Company	..	..	130	145
Consolidated Rubber Tire Co., com	5	12	13	14
Consolidated Rubber Tire Co., pfd	5	20	50	60
Firestone Tire & Rubber Co., com	178	180	328	335
Firestone Tire & Rubber Co., pfd	108	110	105	107
Garford Company, preferred	..	..	100	102
General Motors Company, com	34	36	32	34
General Motors Company, pfd	77	78	76	78
B. F. Goodrich Company, com	..	..	64	65
B. F. Goodrich Company, pfd	..	..	103	105
Goodyear Tire & Rubber Co., com	330	335	440	450
Goodyear Tire & Rubber Co., pfd	104	106	104	105
Hayes Manufacturing Company	..	..	..	90
International Motor Co., com	..	..	10	20
International Motor Co., pfd	..	..	40	60
Lozier Motor Company	..	..	..	38
Miller Rubber Company	..	..	160	170
Packard Motor Company, pfd	105	107	104	106
Peerless Motor Company	..	..	120	125
Pope Manufacturing Co., com	38	40	35	36
Pope Manufacturing Co., pfd	68	70	79½	80½
Reo Motor Truck Company	8	10	9	10
Reo Motor Car Company	23	25	20	21
Studebaker Company, common	..	..	33½	35
Studebaker Company, preferred	..	..	92	94
Swinehart Tire Company	..	..	110	112
Rubber Goods Mfg. Company, pfd	100	105	105	108
U. S. Motor Company, com	..	..	..	10
U. S. Motor Company, 1st pfd	..	..	..	70
U. S. Motor Company, 2nd pfd	..	..	..	35
White Company, preferred	..	..	105	108
Willys-Overland Company, com	..	..	70½	71
Willys-Overland Company, pfd	..	..	98¾	99¾

and unofficial information since that date indicates that still further reductions in the shortage have been made. At the time of the report there was a net shortage of 34,392.

Last year at this time there was a net surplus of freight cars of 76,814; thus the showing for this year is 111,000 less than last year at the corresponding time.

Heavy snows in several sections delayed freight operation to some extent, but not sufficiently to produce congestion. At latest reports the cars are moving rapidly, but in volume never before equalled in this country. The next fortnightly report, covering the situation up to December 28, will be issued early in January, and it is expected to show a reduction of the net shortage to below 20,000 cars.

Six Elected by M. & A. M.

At a meeting of the Motor and Accessory Manufacturers on December 26, the following concerns were elected to membership:

The Dayton Malleable Iron Company, Dayton, O.; Herschell, Spillman Company, North Tonawanda, N. Y.; North East Electric Company, Rochester, N. Y.; Penberthy Injector Company, Detroit, Mich.; The Portage Rubber Company, Barborton, O.; Tyer Rubber Company, Andover, Mass.

U. S. Motor Issues No Certificates

According to official announcement of the United States Motor Company, the receivers have decided not to take advantage of the authorization of court to actually issue the $1,500,000 of receivers' certificates, permission to do which was given by United States District Judge Hough under date of October 28. The receivers state that pending the judicial sale of the properties, scheduled for January 8, manufacturing schedules will be followed only as hitherto outlined; consisting largely of operations to maintain existing cars.

Market Changes for the Past Week

QUOTATIONS for materials during the past week varied but little from those of the preceding week. The holidays were responsible for a rather noticeable limitation of activity and prices remained at their old levels in almost every case. Steel, copper and lead suffered no change, but tin advanced slowly and steadily throughout the week. It closed 0.5 cent higher per pound than it had opened after Christmas.

Lubricants, oils and fuels remained likewise at their old prices. Cottonseed oil fluctuated a little, but the principal products, petroleum and gasoline, closed as they had opened and without any tendency toward a change of prices.

Japanese silk declined slightly, whereas the Italian product remained at its old price. Outside of the changes just enumerated none took place. The table of prices follows:

Material	Wed.	Thurs.	Fri.	Sat.	Mon.
Antimony, per lb.	.09	.09	.09	.09	.09
Beams & Channels, 100 lbs.	1.61	1.61	1.61	1.61	1.61
Bessemer Steel, Pittsburgh, ton	27.50	27.50	27.50	27.50	27.50
Copper, Elec., lb.	.17 9/20	.17 9/20	.17½	.17½	.17 9/20
Copper, Lake, lb.	.17½	.17⅝	.17⅝	.17⅝	.17⅝
Cottonseed Oil, Jan., bbl.	6.13	6.13	6.14	6.14	6.12
Cyanide Potash, lb.	.19	.19	.19	.19	.19
Fish Oil (Menhaden), Brown	.33	.33	.33	.33	.33
Gasoline, Auto, 200 gals. @	.21	.21	.21	.21	.21
Lard Oil, prime	.92	.92	.92	.92	.92
Lead, 100 lbs.	4.25	4.25	4.25	4.25	4.25
Linseed Oil, prime	.46	.46	.46	.46	.46
Open-Hearth Steel, per ton	28.00	28.00	28.00	28.00	28.00
Petroleum, bbl., Kansas crude	.83	.83	.83	.83	.83
Petroleum, bbl., Pa., crude	2.00	2.00	2.00	2.00	2.00
Rapeseed Oil, refined	.69	.69	.69	.69	.69
Silk, raw, Italy	....	4.35	....	....	4.35
Silk, raw, Japan	....	3.77½	....	....	3.72½
Sulphuric Acid, 60 Beaumé	.90	.90	.90	.90	.90
Tin, per 100 lbs.	50.20	50.25	50.375	50.45	50.75
Tire Scrap	.09⅞	.09⅞	.09⅞	.09⅞	.09⅞

Stoddard-Dayton to Fight for License

Receivers Decline Notice of Cancellation Served Upon the Company by the Owners of the Knight Patents

Testimony Taken in Huber Patent Case—Hardie Buys Interest in Miller Car Company

ANNOUNCEMENT was made last Thursday by receivers of United States Motor Company that notice of cancellation served upon the Dayton Motor Car Company with reference to the license of that company under the Knight sliding-sleeve engine patents had been declined on the part of that company.

Counsel representing the Dayton Motor Car Company have advised the company that in their opinion the contract between the Knight company and the Dayton Motor Car Company contains nothing upon which such cancellation order can be based, predicated upon any act so far performed by the Dayton Motor Car Company.

According to the receivers no move has yet been made to deliver a similar notice of cancellation to the Columbia Motor Car Company.

It was stated with color of authority that the chances favored an immediate withdrawal of the demand for cancellation of the Stoddard-Dayton license.

This is said to be due to the promising prospects of the United States Motor Company, the judicial sale of which is scheduled to take place January 8.

Up to date the creditors' committee reports that slightly in excess of 97 per cent. of all claims against the company have been filed and that before the date of sale practically the whole mass of claims will be represented by the committee.

The second call on the assessment directed to the stockholders was promptly paid by a sufficient number to constitute a majority of the outstanding issues, according to statements of the reorganization committee.

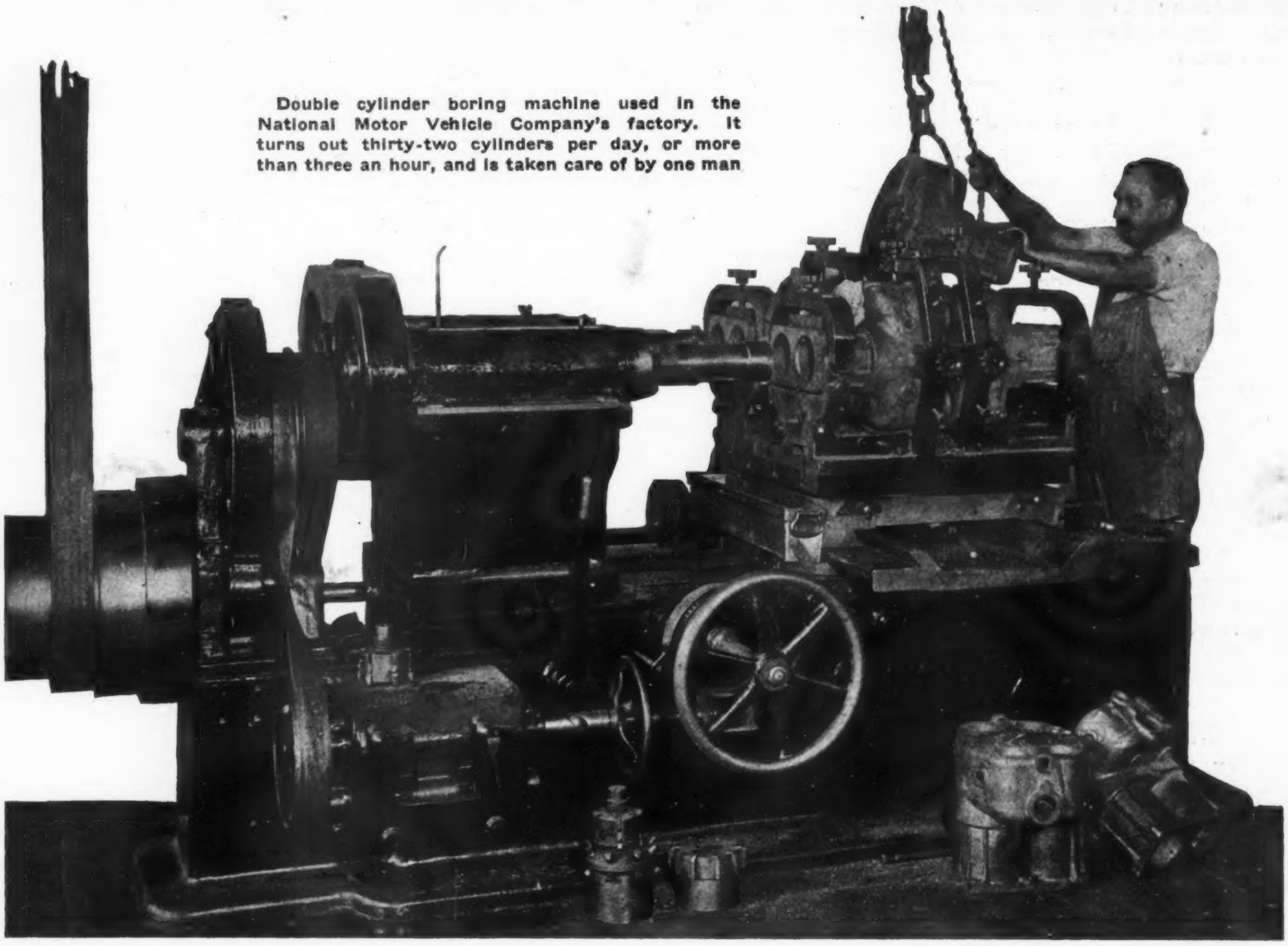
Testimony Taken in Huber Case

DETROIT, MICH., Dec. 30—In an effort to establish a *prima facie* case in the alleged patent infringement case of the North American Vehicle Company against the Detroit Taxicab & Transfer Company, in the federal court at Detroit, Attorney R. A. Parker, representing the complainants, took the deposition of Charles E. Wisner, mechanical designer and engineer, before E. P. Voorheis, United States Court Commissioner. The case involves the Emil Huber patent on three-point suspension of the motive mechanism to the main frame of an automobile and is being defended by the Kelly Motor Truck Company of Springfield, O., whose trucks the Detroit company is using. Engineer Wisner's testimony was to the effect that he considers the variation between the mechanism of certain portions of the truck and the Huber patent immaterial.

Hardie Takes Interest in Miller

DETROIT, MICH., Dec. 30—*Special Telegram*—James M. Hardie, who has been Chicago sales representative of the Miller Car Company of Detroit, has purchased stock in the company and has become secretary, treasurer and general manager. J. C. Hallock, whom he succeeds as secretary and treasurer, will confine more of his energies to the Detroit Excelsior Company, with which he is identified. According to Mr. Hardie the business of the Miller Company will be increased.

Factory Miscellany



Double cylinder boring machine used in the National Motor Vehicle Company's factory. It turns out thirty-two cylinders per day, or more than three an hour, and is taken care of by one man

CUTTING the time of a job in two without the use of extra men means the saving of money. The machine for boring cylinders shown in the above illustration does that very thing. It bores two cylinders at a time and requires the attention of one man. National cylinders are cast in pairs and are of the T-head type. The two cylinders in one block are too close together to work upon at the same time, therefore two blocks are placed in the machine and the outside cylinder in each block is bored. After this operation they are reversed by the aid of a chain fall and a device that looks like an ice tongs and the other two cylinders are bored. The T-head shape of the casting renders this possible on account of the symmetry. Sixteen pairs, or thirty-two cylinders are bored in one day of 10 hours, averaging 3.2 cylinders to the hour or about one cylinder every 19 minutes.

MOON Increased 65 Per Cent.—The Moon Motor Car Company, St. Louis, Mo., has increased its capacity about 65 per cent. in the last few months. This has been achieved by the addition of extra floor space in the building of an extra story and a building attached to the main building, all of which new space has been filled with machinery and is now in operation. The rear axle department recently added a number of new boring mills, and presses, one of 25-ton capacity. The testing department has been moved into a separate building, occupying much more floor space than formerly and now operated under its own power. The company is taking in new men daily and training them into the work.

Another Tractor Factory—The Canada Standard Automobile & Tractor Engine Company, Moose Jaw, Sask., is having plans prepared for a new factory.

Ravenna's Plant—The Ravenna Auto Truck Company, Ravenna, O., is erecting a plant 50 feet by 150 feet, for the manufacture of the Ravenna automobile truck.

Fedders Building—The Fedders Manufacturing Company, Buffalo, N. Y., automobile radiator maker, is building an addition to its plant at Tonawanda street and West avenue.

Chapin Autocycle Builds—The Chapin Autocycle Company, Brantford, Ont., recently incorporated with a capital of $200,000, will erect a factory, employing about 100 men.

Armitage Leather Company Builds—The Armitage Leather Company, Detroit, Mich., recently incorporated with a capital of $35,000, has established a plant at 87 West Congress street.

Louisville Concern Builds—Miller, White & Company, Louisville, Ky., recently incorporated with a capital of $5,000, has secured quarters at Third and Walnut streets, and is now buying machine tools.

Tractor Company Adding—The Killen-Walsh Manufacturing Company, Appleton, Wis., has leased the Double Power Wind Mill Company's plant at that city and is already engaged in the construction of additions.

New Bridgeport Factory—The Bridgeport Auto Company, Bridgeport, Conn., is starting work on its new factory, which is expected to be one of the largest automobile, motor boat and aeroplane factories in the world.

Miller Rubber Factory—Work will be started at once on erecting a four-story brick, steel and concrete factory building for the Miller Rubber Company, Akron, O., to cost $80,000.

Petrolea Planning Addition—The Petrolea Motor Car Company, Petrolea, Ont., plans an addition to its automobile factory in that city. A by-law will be submitted to the taxpayers to grant a $10,000 bonus for the extension.

Budd Building—The Budd Manufacturing Company, Philadelphia, Pa., is having plans prepared for a three-story factory building, 75 feet by 500 feet, to cost about $100,000. The company is manufacturing steel automobile bodies.

Anderson Gear Company Operating—The Anderson Rolled Gear Company, Cleveland, O., has taken over the new plant of the Cleveland Drop Forge Company, and is now operating a number of gear rolling machines on both spur and bevel gear work.

Prest-O-Lite Plant Explodes—The plant of the Prest-O-Lite Company, Indianapolis, Ind., exploded recently. The watchman was killed. The loss was $30,000. The explosion is believed to have come from the boiler, with the result that the plant ignited.

Plant Being Enlarged—The Craig-Center Auto Company, Pittsburgh, Pa., has secured additional vacant property on which it intends to erect additional buildings for show rooms and factory purposes. The new building will have a total floor space of 18,000 square feet.

Herring in New Quarters.—The Herring Motor Company, Des Moines, Ia., is moving into a four-story brick building. One entire floor of the building will be given over to the assembling plant where twenty Ford cars are assembled daily. Another floor will be used by the Herring Motor Supply Company.

Lee & Porter Building—The Lee & Porter Manufacturing Company, Buckhannan, Mich., makers of automobile axles, will at once proceed with the work of erecting a frame addition, with concrete foundations, to its plant, which will be 32 feet by 90 feet. About $8,000 worth of new machinery will be installed.

Club for Goodyear Employees—The Goodyear Tire & Rubber Company of Canada, Bowmanville, Ont., is taking care of its employees in a manner that tends to promote the best feeling between the company and the employee. It has purchased the Balmoral Hotel at Bowmanville and turned it into an up-to-date club for the benefit of the members of its staff.

Plans Another Addition—With two new buildings, aggregating 75,000 square feet of floor space, nearing completion, the Chalmers Motor Company, Detroit, Mich., now announces the erection of a third structure. This new building will be used for general manufacturing purposes and will have 24,000 square feet of floor space. It will be one story in height and 160 feet by 150 feet.

Alco Plant Splendidly Equipped—Among the noteworthy features of the American Locomotive Company's, Providence, R. I., plant is a heat-treating department, having twenty-one furnaces, all run by an automatic instrument, which prevents the metals from being burned. Then there is a chemical laboratory, also a physical laboratory to determine strains and shocks. Another feature of the plant's equipment is a 250,000-pound steam hammer, which cost $51,000 and is the largest in the country. It is used to drop forge the Alco axles and crankshafts. The plant includes twelve buildings on a ten-acre plot.

Factory of the Moon Motor Car Company, St. Louis, Mo.

The Automobile Calendar

Shows, Conventions, Etc.

Jan. 2-10..........New York City, Importers' Salon, Hotel Astor, Importers' Automobile Alliance.
Jan. 4-11..........Cleveland, O., Annual Automobile Show.
Jan. 4-11..........Montreal, Que., Montreal Motor Show, Drill Hall and 65th Regiment Armory.
Jan. 11-18.........Milwaukee, Wis., Annual Show, Auditorium, Milwaukee Automobile Dealers' Association.
Jan. 11-25.........New York City, Thirteenth Annual Show, Madison Square Garden and Grand Central Palace, Automobile Board of Trade.
Jan. 18-25.........Philadelphia, Pa., Annual Automobile Show.
Jan. 21-26.........Toledo, O., Annual Show, Exposition Building, Toledo Automobile Shows Company.
Jan. 25-Feb. 1.....Montreal, Que., Montreal Automobile and Truck Show, R. M. Jaffray, Manager.
Jan. 25-Feb. 1.....Providence, R. I., Annual Show, State Armory, Rhode Island Automobile Dealers' Association, Inc.
Jan. 27-Feb. 1.....Philadelphia, Pa., Truck Show.
Jan. 27-Feb. 1.....Buffalo, N. Y., Annual Automobile Show.
Jan. 27-Feb. 1.....Detroit, Mich., Annual Automobile Show.
Jan. 27-Feb. 1.....Rochester, N. Y., Annual Show, Exposition Park, Dealers' Association.
Jan. 27-Feb. 1.....Scranton, Pa., Annual Automobile Show, Hugh B. Andrews.
Jan. 27-Feb. 13....Troy, N. Y., Annual Show, State Armory, Troy Automobile Club.
Feb. 1-8...........Chicago, Ill., Annual Automobile Show, Coliseum and 7th Regiment Armory.
Feb. 3-8...........Washington, D. C., Annual Show.
Feb. 8-15..........Hartford, Conn., Annual Show, State Armory, Hartford Automobile Dealers' Association.
Feb. 10-15.........Chicago, Ill., Truck Show.
Feb. 10-15.........Minneapolis, Minn., Annual Automobile Show.
Feb. 10-15.........Ottawa, Ont., Ottawa Motor Show, Howick Hall, Louis Blumenstein.
Feb. 11-15.........Binghampton, N. Y., Annual Show, State Armory, Dealers' Association, R. W. Whipple.
Feb. 15-22.........Albany, N. Y., Annual Show, State Armory, Dealers' Association.
Feb. 15-22.........Newark, N. J., Annual Automobile Show, First Regiment Armory, New Jersey Automobile Exhibition Company.
Feb. 16-23.........Richmond, Va., Annual Show.
Feb. 17-22.........Kansas City, Kan., Annual Automobile Show.
Feb. 18-19.........Madison, Wis., Annual Show, City Market Building, Dealers' Association.
Feb. 18-21.........Grand Forks, N. D., Annual Show, Auditorium, Dealers' Association.
Feb. 18-22.........Baltimore, Md., Annual Show, B. A. D. A.
Feb. 19-22.........Bloomington, Ill., Annual Show, Coliseum, McLean County Automobile Club.
Feb. 19-22.........Geneva, N. Y., Automobile Show, Armory, Louis Blumenstein.
Feb. 19-23.........New Orleans, La., Annual Show.
Feb. 19-27.........Topeka, Kan., Annual Show.
Feb. 20-22.........Canadaigua, N. Y., Automobile Show, Louis Blumenstein.
Feb. 22-Mar. 1.....Brooklyn, N. Y., Annual Show, 23rd Regiment Armory.
Feb. 24-27.........Kansas City, Mo., Truck Show.
Feb. 24-Mar. 1.....St. Louis, Mo., Annual Show.
Feb. 24-Mar. 1.....Memphis, Tenn., Annual Show.
Feb. 24-Mar. 1.....Omaha, Neb., Annual Automobile Show.
Feb. 24-Mar. 1.....Paterson, N. J., Annual Show, Paterson Automobile Trade Association.
Feb. 24-Mar. 5.....Cincinnati, O., Annual Show, Music Hall, Cincinnati Automobile Dealers' Association.
Feb. 26-Mar. 1.....Fort Dodge, Ia., Annual Show.
Feb. 26-Mar. 1.....Glen Falls, N. Y., Automobile Show, Louis Blumenstein, Manager.
March 3-8..........Pittsburgh, Pa., Annual Automobile Show.
March 3-18.........Des Moines, Ia., Annual Show, Pleasure Car Section, Coliseum, Dealers' Association.
March 5-8..........Tiffin, O., Annual Show, Tiffin *Daily Advertiser.*
March 8-15.........Boston, Mass., Annual Automobile Show.
March 12-15........Ogdensburg, N. Y., Automobile Show, Louis Blumenstein, Manager.
March 18...........Syracuse, N. Y., Annual Show, Syracuse A. A.
March 19-26........Boston, Mass., Annual Truck Show.
March 20-24........New Orleans, La., Annual Show, N. O. A. D. A.
March 24-29........Indianapolis, Ind., Annual Automobile Show.
Jan. 6.............New York City, Meeting Motor Dealers' Contest Association.
Jan. 14............New York, Beefsteak Dinner, Big Village Motor Boosters.
Jan. 15............New York City, Banquet, Waldorf-Astoria, Motor and Accessory Manufacturers.
Jan. 16............New York City, Meeting, Hotel McAlpin, Society of Automobile Engineers.
Jan. 17............New York City, Banquet, Hotel McAlpin, Society of Automobile Engineers.

Race Meets, Runs, Hill Climbs, Etc.

May 30.............Indianapolis, Ind., 500-Mile Race, Speedway.

Foreign

Jan. 11-22.........Brussels, Belgium, Annual Belgian Automobile Show, Centenary Palace.
March ....France, Sealed Bonnet 3000-Mile Run.
March 31...........Montevidio, Uruguay, International Competition of Agricultural Motor Vehicles.
April ....Barcelona, Spain, International Exhibition.

News of the Week Condensed

One of the views along the Pacific Highway on the borderline between the States of Washington and Oregon

AMERICAN Cars in Majority—Practically all cars purchased in Bahia, Brazil, during 1912, were of American manufacture. Previously the sales had been confined to European cars. The change was due to the fact that two large hardware firms imported a number of American cars. That the Bahia public thought them superior to European cars was evidenced by the early sale of all cars on hand. Larger stocks of 1913 cars are being laid in.

Philadelphia Pullman Moves—The Pullman Automobile Company, Philadelphia, Pa., has moved to 1927 Market street.

Golde Top on Edwards—The Edwards car, manufactured by the Edwards Motor Car Company, New York City, is to be equipped with the Golde patent top.

Republic's St. Louis Branch—The Republic Rubber Company, Youngstown, O., will establish a branch at 2018 Locust street, St. Louis, Mo., with G. M. Hoffman as manager.

Chase Establishes Factory Branch—The Chase Motor Truck Company, Syracuse, N. Y., has established a factory branch in Philadelphia, Pa., with E. F. Howell as manager.

Building New Garage—The Garrison Garage Company, Baltimore, Md., has been formed and is building a handsome garage to accommodate the increased number of automobiles.

Baltimore Secures Show Building—Formal announcement is made that the Fifth Regiment Armory, Baltimore, Md., has been secured again for holding the automobile show from February 18 to February 22, inclusive.

Caten Vice-President—W. L. Caten has just assumed the office of vice-president and general manager of The Speedwell Motor Car Company, Dayton, O. This involves no change in any other officers of the company.

Stage Line in Wisconsin—The first stage line in Wisconsin since the days when horses were hitched to lumbering wagons, has been established between Kiel and Manitowoc, a 45-horsepower KisselKar forming the medium of transportation. The coach seats 32 persons and a driver, and has space for small luggage.

License Yellow and Black—The new automobile licenses for 1913, in Maryland, will be of yellow numbers on black background. These licenses are now being distributed at the office of Motor Vehicle Commissioner Roe.

Heinz Company Organized—The Heinz Motor Company, Baltimore, Md., has been organized and will be located at 533 North Howard street, where it will handle a full line of automobile tires and accessories, as well as automobiles.

Barger Rambler Representative—The Thomas B. Jeffery Company, Kenosha, Wis., makers of Rambler cars, has appointed W. H. Barger, Cleveland, O., as representative for the Cross Country model in that city and northeastern Ohio.

Barnes Promoted—W. R. Barnes has been promoted to district supervisor over the six factory branches of the Goodyear Company, located in Philadelphia, Pittsburgh, Scranton, Pa., Baltimore, Md., Washington, D. C., and Richmond, Va., with his headquarters in Philadelphia.

Colorado's Second Automobile Stage—The establishment of the second automobile stage in Pueblo County, Colorado, has just been reported. A high-powered automobile has taken the place of the old horse-drawn stage line between Pueblo and Beulah, a distance of 30 miles.

Biscuit Company Purchases Trucks—The Toledo Biscuit Company, Toledo, O., which has been experimenting with motor trucks for delivery purposes for some time, has decided to discard horses and has ordered a fleet of trucks from the Toledo Motor Truck Company.

Massachusetts State A. A. Banquet—The Massachusetts State A. A. has planned to have its annual banquet at the Hotel Somerset, Boston, Thursday evening, January 9, at which President Lewis R. Speare will preside and an address will be made by President Laurens Enos of the A. A. A.; George C. Diehl, chairman of the A. A. A. Good Roads Board; A. G. Batchelder, chairman of the A. A. A. executive committee; Colonel W. D. Sohier, chairman of the Massachusetts Highway Commission and President W. D. Parker of the Maine Automobile Association.

New Agencies Established During the Week

PLEASURE CARS

Place	Car	Agent
Beaver Dam, Wis.	Enger	E. H. Peshak
Berwyn, Neb.	Enger	F. Miller
Boston, Mass.	Studebaker	Donovan Motor Car Co.
Carroll, Ia.	Cartercar	Carroll Cartercar Co.
Cedar Rapids, Ia.	Enger	J. E. Elgin
Cleveland, O.	Enger	L. M. Danner
Council Bluffs, Ia.	Enger	J. G. McLean
Craig, Ia.	Moon	Craig Auto Co.
Culbertson, Neb.	Hupmobile	August Sinner
Decatur, Ill.	Moon	N. Main Street Garage
Eaton, O.	Enger	J. A. Longnecker & Son
Geneva, Ind.	Enger	A. P. Hardison
Goehner, Neb.	Nyberg	Geo. Madison
Grinnell, Ia.	Enger	Brownell & La Grange Co.
Hamilton, O.	Moon	Orme Motor & Transfer Co.
Highland Park, Ill.	Franklin	W. B. Ten Broeck
Kansas City, Kan.	Enger	Security Gar. Repair & Sales Co.
Lincoln, Neb.	Hupmobile	Goddard Auto Co.
Lockington, O.	Enger	S. S. Gabriel
Logan, Ia.	Abbott-Detroit	Kennedy Bros.
Maryville, Mo.	Enger	W. W. Jones Co.
Maryville, Mo.	Enger	G. B. Roseberry
Marcus, Ia.	Moon	Johnson, Petty & Johnson
Massillon, O.	Enger	A. H. Coleman
McCook, Neb.	Hupmobile	McCook Mach. & Iron Wks.
Milledgeville, Ill.	Enger	Miller Bros.
Montreal, Can.	Enger	Poiriere, Rossette & Cie
New Haven, Conn.	Moon	J. J. Laverty
North English, Ia.	Enger	W. C. Carson & Co.
Pawnee City, Neb.	Studebaker	O. H. Schenk
Red Oak, Ia.	Cartercar	Whitaker Implement Co.
Rosenberg, Tex.	Moon	Rosenberg Automobile Co.
Sharpsburg, Pa.	Enger	Aupke Brothers
Shelby, Neb.	Enger	McBeth Brothers
Sioux City, Ia.	Moon	Bennett Auto & Supply Co.
Valentine, Neb.	Hupmobile	Valentine Auto Co.
Wall Lake, Ia.	Moon	Hopkins & Herrig
Waterloo, Ia.	Franklin	Cramer & Bennett
Waukesha, Wis.	Enger	F. E. Shrader
Youngstown, O.	Moon	Regal Sales Co.

COMMERCIAL VEHICLES

Place	Car	Agent
Boston, Mass.	Stewart	H. Ross Maddocks
Chicago, Ill.	Stewart	Voltz Bros.
Hartford, Conn.	Stewart	Capital City Auto Sales Co.
Montreal, Que.	Stewart	Ralph Careau
Pittsburg, Pa.	Stewart	Alco-Pittsburgh Sales Co.
San Francisco, Cal.	Stewart	S. G. Chapman
St. Louis, Mc.	Wilcox Trux	Wilcox Trux Sales Co.
Washington, D. C.	Stewart	D. S. Hendrick

Move Salesrooms—Hess & Son will be located at 1031 Chestnut street, Philadelphia, Pa., after January 1.

Marble Purchases Company—W. H. Marble has purchased the personal property of the Leighton Auto Company, Brockton, Mass.

Gentry, Laplock Manager—H. C. Gentry has been appointed manager of the New York City branch of the Stein Laplock Tire Company.

Titus, Southern Alco Representative—F. J. Titus has been appointed southern representative of the American Locomotive Company, Providence, R. I.

Engler, Chief Engineer—W. B. Engler has been promoted to the post of chief engineer of the General Motors Truck Company, Pontiac, Mich. He will be in charge of the experimental and development work.

Cartercar's Atlanta Factory Branch—The Cartercar Company, Pontiac, Mich., has established an Atlanta, Ga., factory branch with W. C. Mahoney manager. The address of the new branch is 242 Peachtree street.

By Way of Correction—In the issue of THE AUTOMOBILE on December 19, 1912, a typographical error was made in describing the Marathon car. The Runner roadsters have three speeds forward, instead of two.

Moline Purchases Truck—Moline, Ill., is to purchase an additional fire truck, the city commission having decided to dispose of its remaining horse-drawn apparatus and increase the efficiency of the department with motor apparatus.

Pence Receives 150 Buicks—The Pence Automobile Company, Minneapolis, Minn., has received a train load of fifty freight cars of Buicks from the factory at Flint, Mich. The train left Flint December 24 and reached Minneapolis over the Milwaukee road December 27. The shipment was 150 automobiles.

United States Purchases Alcos—The United States Government has purchased from the American Locomotive Company, Providence, R. I., four trucks, two of which will be employed in army activities at the West Point post, and the others in salvage work in the fire department at Manila.

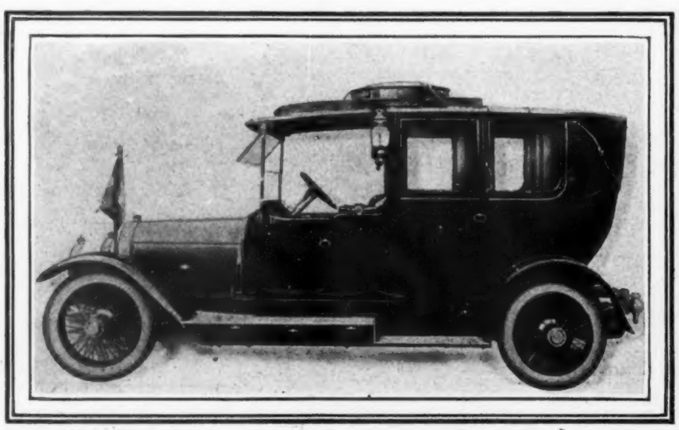
Want Ohio Assembly Aid—Extensive aid will be asked of the Ohio General Assembly this winter in the campaign of road building. The movement to have the General Assembly make direct levies for good roads has gained impetus since the defeat of the constitutional amendment to issue bonds.

Baltimore's Automobile Bank—The first automobile bank to be established in Baltimore, Md., went into service recently. This bank is used by the German-American Bank of Baltimore, and was put into service to enable the bank to accommodate its depositors in outlying sections of the city.

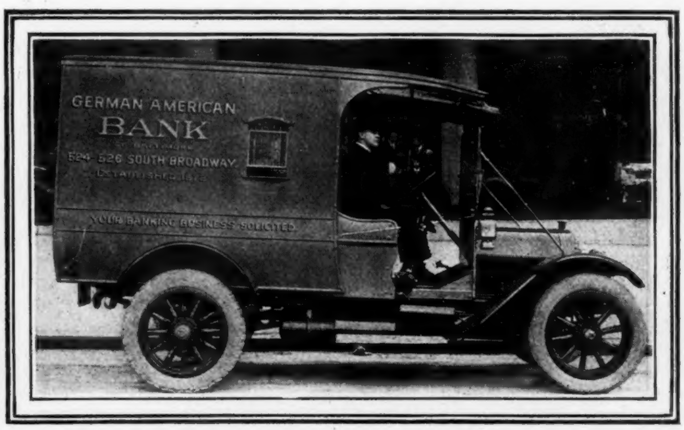
Milwaukee Company Bankrupt—The Bates-Odenbrett Automobile Company, Milwaukee, Wis., has been closed by involuntary bankruptcy proceedings. It is believed that a reorganization will be effected and the business, which apparently was one of the best in Milwaukee, continued.

Both Shaffers Add Agencies—R. M. Shaffer, of the Shaffer Manufacturing Company, Baltimore, Md., has become sales agent for the Pullman car, while Charles A. Shaffer, son of R. M. Shaffer, of the same company, has taken on the agency for the Selden car and will have offices and salesrooms with the company, which also handles the R. C. H. car here.

Want Ohio Assembly Aid—Extensive aid will be asked of the Ohio General Assembly this winter in the campaign of road building. The movement to have the General Assembly make direct levies for good roads has gained impetus since the defeat of the constitutional amendment to issue bonds. It is estimated that this would raise between $3,000,000 and $3,500,000 annually.



The Queen of the Netherlands' 30-horsepower Spyker automobile has been fitted with Rudge-Whitworth detachable wire wheels. The car, a torpedo-landaulet-limousine, carries a spare wheel on the right running board of the car and one on the roof of the body



The city of Baltimore now possesses an automobile bank, the Chalmers chassis and Zell body here shown having been designed for the German-American Bank. The wooden body on the 30-horsepower chassis is finished as in steel and fully equipped for its purpose

Electric signs blazed at the Paris Salon and electroliers increased their magnificent impression

Marble Resigns—C. L. Marble, purchasing agent for the Abbott Motor Company, Detroit, Mich., has resigned.

Schott to Move—About January 1, S. W. Schott, Columbus, O., distributor for the Empire and Brush cars, will move his headquarters to 237 North Fourth street.

Frisco's Apparatus Complete.—San Francisco, Cal., has recently added a new high pressure Pope-Hartford hose wagon, which makes its fire fighting apparatus complete.

Coral for Surfacing Road—Coral is to be used in surfacing the new road which is to be built from New Orleans, La., to the Southern Yacht Club's properties on Lake Pontchartrain.

Washington Man Bankrupt—A voluntary petition in bankruptcy has been filed by Frederick K. Barbour, Washington, D. C., whose assets are listed at $4,438 and his liabilities at $9,021.

Erecting New Garage—The Yager Motor Car Company, Louisville, Ky., agent for the Hupmobile and Peerless cars, is erecting a new garage at Third avenue and the L. and N. railroad crossing.

Handles Walpole Tires—The Bracken Stanton Company, Columbus, Ohio, is the name of a new concern which has opened a tire business at Fourth and Gay streets and will handle the Walpole tires.

Tennant Resigns—C. A. Tennant, connected with the Sundry Department of the Franklin Automobile Company, Syracuse, N. Y., for the past five years, has resigned to accept a position with the Middlesex Bridge Company of New Brunswick, N. J.

Truck Proves Value—An automobile delivery truck furnished by the Post Office Department to the Selma, La., office has proven its worth. During the Christmas rush the use of the truck enabled the delivery of all mails on the usual schedules.

Adds Extra Garage—The T. C. Bradford Automobile Company, Wilmington, Del., has taken possession of the Postles garage, adjoining its garage, and is occupying both, additional room having been required since the Bradford Company inaugurated a taxicab service.

Wolverine Club to Move—The directors of the Wolverine Automobile Club have decided to move their headquarters not later than January 15. It is reported that the club will select the Tuller Hotel, where a dining room on the first floor will be converted into a clubroom 50 feet by 50 feet.

Shuman Cales Manager—C. S. Shuman, who has had charge of the Burn-Boston Battery Company's business in New York City, has ben made sales manager of the Automobile Supply & Manufacturing Company of Brooklyn, N. Y. This company makes the Newtone electric horn, also bulb horns.

Wilmington Company Adds—The Wilmington Automobile Company, Wilmington, Del., has opened an extension in the rear, with a frontage of about 100 feet. The rear section was a public stable until bought by the automobile company, which had it rebuilt. The main building and extension are of brick and concrete construction.

Studebaker to Move—The Studebaker Company, of Minneapolis, Minn., has made a lease for a three-story building, to be erected on a site 75 feet by 154 feet at Fourteenth street and Hennepin avenue in the heart of automobile row. Work will begin at once and the building will be ready by spring. The structure will cost about $75,000.

Des Moines Space Sold—All the space for the fourth annual Des Moines automobile show, to be held at the Coliseum March 3 to 14, has been sold and firms are still seeking admission. This in spite of the fact that the show has been lengthened to a two-weeks affair with pleasure cars only shown the first week. Arrangements are now being made for an overflow show.

Closes Garage—Following is the new policy of the Olds Motor Works to withdraw its wholesale branches in several cities and to handle the wholesale business through its factory at Lansing, Mich., the three-story garage at 728-730 South Fourth avenue, Louisville, Ky., the finest garage in Kentucky, has been sold. The consideration, it is understood, was close to $75,000.

Milwaukee's Two Cars—Milwaukee, Wis., has just placed in service two new motor police patrol and ambulance cars, built according to Milwaukee's specifications by the Kissel Motor Car Company, of Hartford, Wis. The cars cost $3,500 each and supplant three horse-drawn patrols now used by the

Automobile Incorporations

AUTOMOBILES AND PARTS

APPLETON, WIS.—Killen-Walsh Manufacturing Company; capital, $100,000; to manufacture an automobile tractor. Incorporators: W. H. Killen, W. L. Walsh, W. J. Walsh, William Strait.

BALTIMORE, MD.—Maryland Motor Car Insurance Company; capital, $300,000; to insure automobiles. Incorporators: J. C. Fenhager, W. Whitridge, W. G. Bowdoin, J. P. Bonsal.

BOSTON, MASS.—R. B. Nettleton Company; capital, $1,000; to deal in automobiles. Incorporators: R. S. Barlow, S. G. Barker.

BOSTON, MASS.—Norwalk Motor Car Company; capital, $75,000; to deal in automobiles. Incorporators: C. C. Smith, J. W. Briggs, M. A. Beaudet.

CHICAGO, ILL.—Marmon Automobile Company; capital, $20,000; general automobile business. Incorporators: M. E. Horn, C. E. Worbstein, E. J. Ehlers.

CLEVELAND, O.—Praco Manufacturing Company; capital, $15,000; to manufacture automobile lamps. Incorporators: H. G. Smith, J. C. Hipp, T. J. Smith, Tony Laness, Dan Pfahl.

DETROIT, MICH.—Detroit Armature & Motor Works; capital, $10,000; to manufacture automobile parts. Incorporators: W. J. Harting, J. S. Keightley, M. E. Reynolds.

JUNEAU, WIS.—Juno Motor Truck Company; capital, $125,000; to manufacture automobiles. Incorporators: L. C. Pautsch, H. A. Henning.

NEW YORK CITY—Eureka Auto Dispatch; capital, $1,000; automobile express. Incorporators: R. C. Cuyler, J. C. Stewart, F. T. Lind.

MORRISTOWN, N. J.—Morristown Auto Company; capital, $25,000; general automobile business. Incorporators: J. J. Lyons, L. Van Gasbeek, A. Newkark.

NEW ORLEANS, LA.—J. A. Landry Motor Car Company; capital, $25,000; to deal in automobiles. Incorporators: J. A. Landry, J. B. Avegno, R. J. Monroes.

NEW YORK CITY—Haverty's Taxicabs Incorporation; capital, $1,000; to carry on a taxicab trade. Incorporators: Charles O'Brien, Charles O'Brien, Jr., Margaretta V. Curran.

NEW YORK CITY—Vaughn Car Company; capital, $1,000,000; to manufacture automobiles. Incorporators: R. C. Thompson, Julius Kahn, Paul Kammerer.

QUINCY, ILL.—Broadway Auto Sales Company; capital, $2,500; to deal in automobiles. Incorporators: Alex. Thompson, J. G. Stuart, J. G. Clough.

SAN ANTONIO, TEX.—Motor Car Supply Company; capital, $5,000; to deal in automobiles and accessories. Incorporators: C. P. Guthrie, H. B. Lyne, James Harrison, Will Harrison.

SOUTH BEND, IND.—Cadillac Motor Sales Company; capital, $10,000; to deal in automobiles. Incorporators: N. A. Otis, G. H. Grieger, E. W. Steinhart.

South, West and Bay View police stations. One horse patrol is abolished entirely.

Operated by Gasoline Motors—The Badger Electric Railway & Power Company, Jefferson, Wis., which is to build an interurban railway from Lake Geneva, Wis., to Watertown, Wis., via Jefferson, announces that it will operate its cars by gasoline motors instead of by electricity. It will be the first interurban or street railway line in Wisconsin to employ gasoline motors for this purpose.

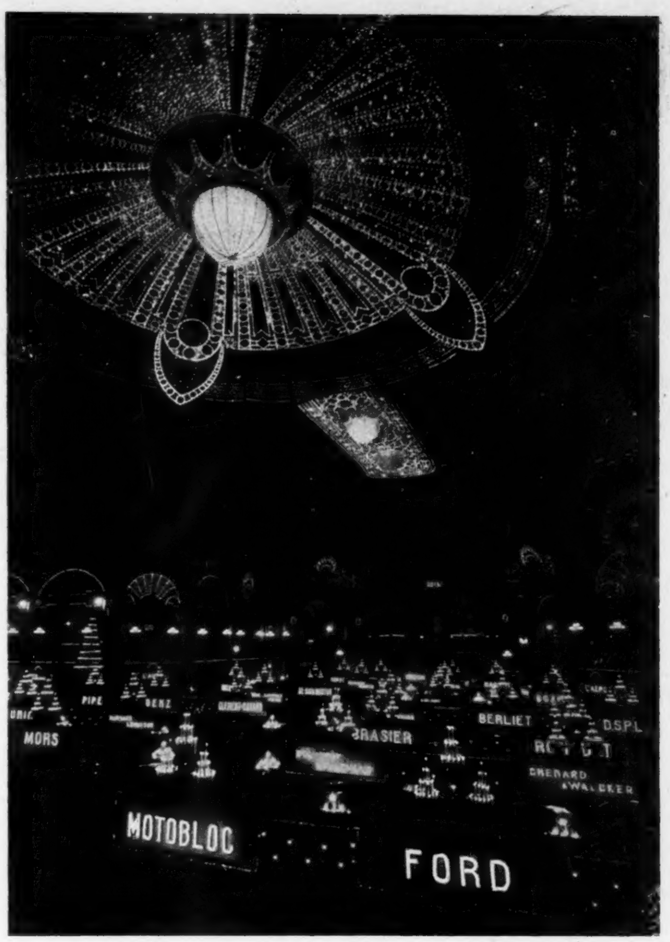
Grossman Establishes English Branch—Upon his recent visit to London, Mr. Emil Grossman established an English company known as the Emil Grossman Company, under the management of Messrs. Krauss & Auerbach, at 144 Queen Victoria street, London, E. C. This branch will be the distributing depot and center of activity in Europe to support the invasion of Europe by the Red Head spark plug.

Smith-Hoppe Chalmers Agents—By taking on the Chalmers line, the Smith-Hoppe Auto Company, 215 Wisconsin street, now carries the two original lines of the Kopmeier Motor Car Company, of Milwaukee, Wis., the Detroit electric and Chalmers. The Kopmeier company now represents the Fiat and Flanders gas and electric cars, while Smith-Hoppe represents the R. C. H., Hupp-Yeats, Chalmers and Detroit.

Columbus Buys Automobile—The Columbus, O., postoffice has arranged for an automobile service for deliveries in the new parcel post system which becomes effective January 1. Postmaster Krumm has arranged for one automobile to take up the service at the beginning, but the number will be increased as occasion demands. It is believed a half dozen cars will be necessary to take care of the business within 6 months.

Spitzley and Bush Resign—B. C. Spitzley, general manager, and W. T. Bush, general sales manager, have resigned their connections with the Abbott Motor Company, Detroit, Mich., according to a report which has been confirmed. No statement has been given out by either of the officials and no inkling as to their plans for the future has been given to the public. Mr. Spitzler has just returned from a western trip for the company.

Concerning Franklin Conferences—A conference of the Franklin automobile dealers in the New England territory was held recently at the Franklin factory, Syracuse, N. Y., with Robert H. LaPorte, New England district sales manager, presiding. The Franklin dealers in the Pacific Coast territory will hold a conference at the Franklin factory on January 9, with John F. McLain, district sales manager of the coast territory, presiding.



Interior view of the Paris Salon at night, showing splendid scheme of illuminating the hall

Winter Sheboygan President—A. F. Winter has been elected president of the Sheboygan, Wis., Automobile Club, which recently was rejuvenated and now has a total of nearly 200 members. J. H. Optenberg was elected vice-president and Arthur F. Raab is the new secretary and treasurer. T. M. Bowler continues as counsel and will take an important part in the Wisconsin State A. A.'s work before the coming session of the Legislature.

Propose New Indianapolis Ordinance—The Hoosier Motor Club, Indianapolis, Ind., has asked the advisory commission to Mayor Shank, of that city, to indorse a proposed ordinance forbidding automobiles to go around street cars on the left-hand side. The club will submit such an ordinance to the city council at an early date and will use its influence to have it passed. The habit of going around street cars on the left side is regarded by the club as a dangerous one.

Indianapolis Has Successful Season—One of the best indications of the successful automobile business in Indianapolis, Ind., during 1912, was the large increase in the number of automobile licenses issued by the city, as compared with 1911. The number of licenses issued was 3466, as compared with 2600 in 1911. Licenses issued in 1912 were classified as follows: runabouts and roadsters, 1300; touring cars, 1802; light trucks, 172, and trucks of more than one thousand pounds, 192.

Galveston-Winnipeg Road—The final step was taken in logging the Meridian Winnipeg, Can., to Gulf automobile road, when J. C. Micholson, secretary of the Meridian Road Association arrived in Galveston, Tex., from Winnipeg, having covered a distance of 2,000 miles by automobile. There is a very important feature to this highway which should be borne in mind. Winnipeg, a city of 200,000 population, is so situated that Galveston, in point of actual distance, is the nearest deepwater port, with the exception of the Great Lakes outlets, which are closed to traffic several months out of the year on account of ice.

Automobile Incorporations

TORONTO, ONT.—McKinnon Motor Vehicle; capital, $100,000; to manufacture automobiles. Incorporators: T. S. Blues, G. B. Mansfield, D. J. McKinnon.

WORCESTER, MASS.—Maykel Automobile Company; capital, $12,500; to deal in automobiles. Incorporators: M. K. Maykel, M. L. Katz, A. Massad.

GARAGES AND ACCESSORIES

BIRMINGHAM, ALA.—Blacklock Tire & Rubber Company; capital, $3,000; to manufacture automobile tires. Incorporators: Kate Blacklock, Mary H. Bostick, H. Blacklock.

BRIDGEPORT, CONN.—Jones Pneumatic Tire Spring Company; capital, $100,000; to manufacture automobile tires. Incorporators: Lyman D. Jones, E. E. Brandreau, Clarence R. Hall.

CHICAGO, ILL.—Aldine Auto Livery; capital, $2,500; automobile livery business. Incorporators: C. A. Dickinson, A. B. Lapham, W. R. Scates.

DETROIT, MICH.—Armitage Leather Company; capital, $35,000; to manufacture leather for automobile use. Incorporators: Edwin Armitage, W. S. Gurd, R. B. Gillespie.

JAMESTOWN, N. Y.—Eagle Garage Company; capital, $25,000; to engage in a garage business. Incorporators: S. B. Rubbins, Olive M. Spencer, George Rappole.

LOUISVILLE, KY.—Miller, White & Company; capital, $5,000; to deal in automobiles. Incorporators: R. W. Miller, A. W. White, William Atix.

NEW YORK CITY—Favary Tire Company; capital, $300,000; to deal in tires and accessories. Incorporators: E. Favary, M. W. Brashears, C. S. Boyd.

NEW YORK CITY—Wholesale Automobile Tire Company; capital, $1,000; to deal in automobile tires. Incorporators: W. P. Cole, David Morris, Abraham Levy.

NEW YORK CITY—Macandaryba Tire Filler Company; capital, $25,000; to manufacture automobile tires. Incorporators: Moses Haas, Nathaniel Levy, G. A. Weingetz.

TOLEDO, O.—Rubber Nix Manufacturing Company; capital, $10,000; to manufacture an insoluble compound containing no rubber invented by E. A. McLean. Incorporator: E. A. McLean.

WILLIAMSON, N. Y.—Williamson Garage Company; capital, $20,000; to carry on a general garage business. Incorporators: R. S. Carr, C. I. Dezutter, A. F. Raymor.

CHANGES OF CAPITAL AND NAME

COLUMBUS, O.—Peerless Motor Car Company; increase of capital from $3,000,000 to $10,000,000.

DETROIT, MICH.—Detroit Carriage Company; change of name to Detroit Body Company.

DETROIT, MICH.—Von Bloerck Motor Company; increase of capital from $10,000 to $100,000.

Patents Gone to Issue

ANTI-Skidding Device—Comprising transverse members spanning the tire tread and being attached to their base so as to be capable of swiveling movement.

This patent refers to an anti-skidding device comprising anti-skid elements which are pivoted to the wheel and are provided with wear members, W, hinged at H. These wear members are so arranged that they overlap each other on the tire tread, as shown in Fig. 1. The anti-skid members are provided with resilient means, R, which yieldingly resist to the movement of the wear members W. This allows for a slight movement of the wear members on the tread surface, which is essential in preventing excessive wear of the latter.

No. 1,048,376—to Rudolph Thiesen and Campbell Thomas King, Jr., Atlanta, Ga. Granted December 24, 1912; filed December 23, 1911.

Baffle-Plate Muffler—In which liquid is used to guide the exhaust gases in their path.

Fig. 2 illustrates the subject matter of this patent, a muffler which has inlet and outlet ducts, the former, I, being connected to the exhaust pipe of the motor, and the latter, O1, to a body of liquid, whereby the gases escaping in this manner are silenced through their work of overcoming the resistance offered by a column of the liquid. A part of the muffler casing is formed as an expansion chamber, C, in which suitably constructed baffle plates, B and B1 are so arranged that the gases must pass through this chamber in a zigzag way, being afforded an opportunity for silent expansion while doing so. Means are provided for introducing a sheet or film of water across the path of the gas coming in through the inlet ducts, so as to cool the exhaust and somewhat reduce its volume.

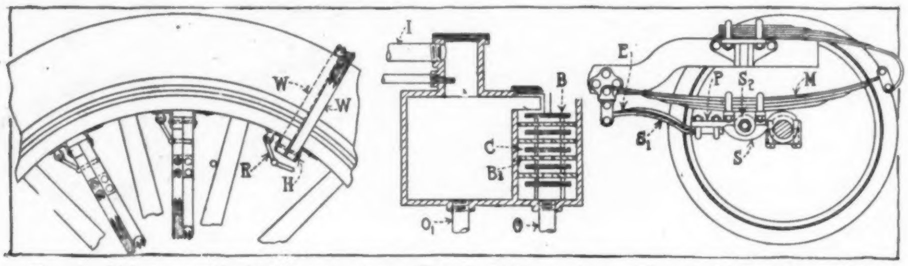


Fig. 1—Thiesen anti-skidding device. Fig. 2—Still muffler. Fig. 3—Neuberth spring suspension

No. 1,048,435—to Vernon B. Still, Patchogue, L. I., N. Y. Granted December 24, 1912; filed April 4, 1912.

Automobile Spring Suspension—Consisting of a small elliptical spring supplemental to the main spring in its action.

The spring described in this patent has the purpose of assisting the main elliptical suspension spring of the car in its work and also to serve as a rebound check, being adapted to compensate for excessive deformation of the main spring. It consists of a leaf spring, S1, attached to the end of a plate, P, which is formed by the free end of a saddle, S, the latter being secured to the axle of the car. The spring S1 projects beyond the plate P, and with the saddle S forms a lever having a gradual resiliency toward its outer end, E, which is secured to the body of the car. It may be noted in Fig. 3 that saddle S and spring S1 are of approximately the same length. A main spring, M, is secured at its ends to the car body and is supported at the center by a saddle, S2, which is arranged equidistantly between the axle and the supplemental leaf spring S1.

No. 1,048,336—to George E. Neuberth, Newark, N. J. Granted December 24, 1912; filed October 10, 1910.

Incandescent Headlight Lamp—Consisting of two filaments contained in the same bulb.

In Fig. 4 the headlight idea described in this patent is illustrated, the lamp consisting of a parabolic reflector and a bulb, B, mounted in its apex. In the bulb, which has two bases, B1 and B2, two filaments, F1 and F2, are contained, the former of which is located practically in the focal point of the parabolic reflector, while F2 is farther from the apex than this point. The rays of the filament F1 produce a beam of light parallel as it emanates from the reflector, while the shadow formed in this beam by the base B2 is dissolved by the intersecting rays of the filament F2, which is out of focus with respect to the parabolic reflector.

No. 1,048,017—to Theodore A. Willard, Cleveland, O. Granted December 24, 1912; filed February 9, 1910.

Tire-Patching Device—Consisting of bracing means for keeping a tire in place on a wheel-shaped carrier while it is being repaired.

This patent describes a tire-patching device, Fig. 5, comprising a flanged rim, R, on which a tire, T, is mounted, a flexible patching strap, P, extending across the tread portion of the tire. To one extremity of the strap a bar, B, is secured which rests on the outer extremity of the rim flange; a hook member, H, passes through the bar and engages one rim flange. The other end of the strap is secured at S to the rim.

No. 1,048,189—to Gustave J. Martel, Chicago, Ill. Granted December 24, 1912; filed July 21, 1911.

Internal-Combustion Engine—In which each working cylinder works in parallel with a pumping cylinder.

Fig. 6 shows the subject matter of this patent. The engine described in this patent consists in its simplest form of a working cylinder, C, and a pumping cylinder C1. A piston P is mounted in the working cylinder which compresses an explosive mixture at the end of each stroke, which mixture is exploded to impart reciprocating movement to the piston. The cylinder C has centrally disposed intake and outlet ports Q1. A pumping piston, P1, in the cylinder C1 is moved in the same sense and at the same speed as P. A carbureter is also mentioned in this patent, and a cylindrical casing, C2, is in place between it and the cylinder C1. A valve mechanism in this casing controls the admission of mixture to the two inlet ports located in the ends of the cylinder C1. Another casing between C1 and C regulates the passage of mixture from the former to the latter cylinder, the control mechanism consisting, in both cases, of a slightly tapered rotary valve having two oppositely disposed, superimposed ports making communication between proper passages in the casing to regulate admission and exhaust. This construction makes possible the working of the engine on the two-stroke cycle and without the use of poppet valves, insuring a plain and efficient combustion chamber.

No. 1,048,095—to Ralph Tagan, Atlanta, Ga. Granted December 24, 1912; filed July 24, 1911.

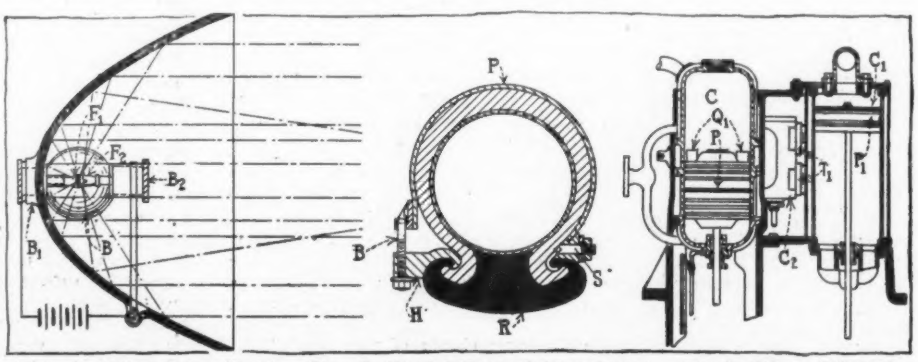


Fig. 4—Willard headlight. Fig. 5—Martel tire-patching device. Fig. 6—Tagan internal-combustion engine